

STANDARD VALUES *in* BLOOD

*Being the first fascicle of a Handbook of
Biological Data*

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Prepared under the Direction of the Committee
on the Handbook of Biological Data
AMERICAN INSTITUTE OF BIOLOGICAL SCIENCES
THE NATIONAL RESEARCH COUNCIL

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Foreword

On January 31, 1949, the National Academy of Sciences - National Research Council contracted with the Wright Air Development Center, United States Air Force, to gather and compile for publication the more basic established data on the composition and reactions of blood. A compact volume was desired that would contain authoritative tabular data of most pressing need to scientists working in the various fields of biology, including the medical sciences. The present work, first issued as Air Force Technical Report No. 6039, is the result.

The direction of the work was entrusted to the Committee on the Handbook of Biological Data, an organ of the American Institute of Biological Sciences. The Institute is affiliated with the National Research Council as a unit in the Council's Division of Biology and Agriculture. The membership of the Committee is representative of the major fields in plant and animal biology.

Seeking the highest degree of authoritativeness for the work, the Committee recognized that the specialist in a field from which a table is drawn can best exercise the critical judgment necessary to evaluate and select data for an authoritative table. The specialist can best identify those data born of the most acceptable methods of measurement and those having the greatest likelihood, or actual history, of reproducibility in competent hands. The Committee accordingly prescribed that in the selection and review of data the broadest collaboration be sought among investigators in hematology and related fields.

To the Editor has fallen the responsibility of determining the table of contents and the format and composition of each table as it appears on the page, and of enlisting the aid of contributors to supply the necessary data and of reviewers to give the data independent evaluation. The editorial office has also been the focus of advice and counsel sought and received in generous measure from all fields of biology *

Acknowledgment is made, on behalf of the Committee, to the Wright Air Development Center, United States Air Force, for the foresight and scientific judgment inherent in the commission to prepare this tabular monograph on blood, to the biologists of this and other countries whose generous devotion of time as contributors and reviewers has made possible the completion of the work as it stands, and to the many others, unlisted, who have given the Committee solicited advice.

Acknowledgment is made to Dr. Cloyd Heck Marvin, President of The George Washington University, for generously making it possible for a member of his faculty to assume the editorship; to Dr. J. W. Heim, member of the Committee and project director for the Wright Air Development Center, for his unflinching effort toward bringing to realization the idea of a handbook of tabular biological data, and to Dr. Ulrich K. Henschke for giving the manuscript meticulous and critical study.

Finally the Editor acknowledges with gratitude the loyalty and labors of his administrative assistant, Mrs. Dorothy C. Stafford, and of his staff of research analysts, Dr. Habeeb Bacchus, Mr. Harold J. Berman, Mr. Albert Enneber, Mr. Howard L. Gordon, Mr. Louis P. Munan, Mr. William S. Spector and Dr. Wasley D. Yushok.

ERRETT C. ALBRITTON

*Two other comparable collections of tabular data are nearing completion as the present work goes to press, one drawn from the field of nutrition and metabolism and the other from that of growth, reproduction and life history. Both plant and animal forms are included. Other collections are planned.

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Introduction

The tables in this unusually complete collection of data on blood are unique in the high degree of reliability sought for the data. Data have been supplied and authenticated by over six hundred leading investigators in biology and clinical medicine. The tables have been exhaustively reviewed, some by as many as twenty experts in the field.

The tables are also unique in their treatment of the well known phenomenon of biological variability. In addition to giving a single representative value for each item covered in a table (the value is known in statistical terms as the estimated "universe mean") the tables present information on variability in a most easily comprehensible and directly usable form. The reader who seeks to know the range of variation of a quantity does not need to perform a calculation, as he must do when only the "standard deviation" is reported, but may read directly from the table the estimated upper and lower limits of the "95% range." The method of estimate, in each case, is identified by a simple code letter, which at the same time rates the individual range as to its trustworthiness. Range data as commonly encountered represent a mixture of variability as it exists between individuals and variability as it exists within individuals.

The significance of the code letters, used as superscripts attached to the ranges in the tables, follows:

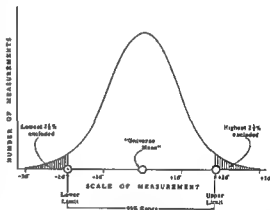
(a) By the method of greatest accuracy, the 95% range is obtained by fitting a recognized type of frequency curve to a group of measured values and excluding the extreme 2.5% of area under the curve at each end. (See sketch to the right.)

(b) By a less accurate method, the 95% range is estimated by a simple statistical calculation, assuming a "normal distribution" and using the "standard deviation." This estimate is used when the group of values is too small for curve fitting, as is usually the case.

(c) A third and still less accurate procedure for estimate of the 95% range is simply to give the highest value and lowest value of the reported sample group of measurements. It underestimates the 95% range for small samples and overestimates for larger sample sizes, but may be used in preference to the preceding method when the sample shows convincing evidence that the variable is asymmetrical in distribution.

(d) The upper and lower limits of the range of variation, as commonly encountered by an investigator experienced in measuring the quantity in question, constitute still another estimate of the 95% range. The trustworthiness of limits so placed should not be underestimated.

In many instances, where information as to the manner of estimate has been lacking at the time of going to press, it has been necessary to report an estimate of the 95% range without an identifying superscript. Effort to assemble the missing information is continuing.



Although the data in each table are the best available at the time the table was prepared, it is recognized that all data are subject to revision as investigators improve techniques and make more measurements. The reader is warned against attributing significance to small differences from species to species. He is invited to submit any values or ranges that he feels should be given consideration, and is particularly invited to add to the coverage of animal forms.

TABLES

1. BLOOD SPECIFIC GRAVITY

Blood (B), RBC (C), Plasma (P)

Animal		Value		Range	Temperature (°C)	Method
(A)		(B)		(C)	(D)	(E)
1	Man	B	♂ 1.056	1.052-1.061 ^b	25/4	Copper Sulfate
2		C	♂ 1.093 ²	1.089-1.097 ^b		
3		P	♂ 1.024	1.022-1.026 ^b		
4		C	1.099	1.094-1.107 ^c		
5	Cat	P	1.028	1.026-1.031 ^b	T/T	Gravimetric
6		B	♂ 1.050	1.046-1.054 ^b		
7		B	♀ 1.051	1.045-1.057 ^b		
8		B	♀ 1.052	1.046-1.058 ^b		
9	Cattle adult ^{3,4} young ^{3,5} adult	B	♀ 1.053	1.046-1.061 ^b	20/4	Gravimetric
10		C	♂ 1.084	1.079-1.090 ^b		
11		P	♂ 1.029	1.026-1.033 ^b		
12		B	1.052			
13	Dog adult ⁶ young ⁷	B	1.045		22-26/4	Falling Drop
14		B	♂ 1.042	1.036-1.048 ^b		
15	Goat ⁸	B	♀ 1.044	1.036-1.051 ^b	25/4	Copper Sulfate
16		B	♂♀ 1.042	1.035-1.049 ^b		
17		P	♂ 1.023	1.019-1.026 ^b		
18		P	♀ 1.021	1.018-1.024 ^b		
19		P	♂♀ 1.022	1.019-1.025 ^b		
20		B	♂♀ 1.053	1.046-1.059 ^c	20/4	Benzene-Chloroform
21	Mouse ¹⁰	B	1.057	1.052-1.062 ^b	25/4	Falling Drop
22	Pig, young ¹¹	B	♂ 1.047	1.038-1.055 ^b	25/4	Copper Sulfate
23		B	♀ 1.043	1.035-1.052 ^b		
24		B	♂♀ 1.046	1.039-1.054 ^b		
25		P	♂ 1.022	1.021-1.025 ^b		
26		P	♀ 1.023	1.020-1.027 ^b		
27		P	♂♀ 1.022	1.019-1.025 ^b		
28	Rabbit	B	1.050	1.048-1.052 ^b	25/4	Falling Drop
29		C	1.098	1.093-1.104 ^c		
30		P	1.025	1.018-1.031 ^b		
31		B	1.056 ¹²	1.054-1.058 ^b		
32	Rat ¹³	B	♂ 1.054	1.046-1.061 ^b	25/4	Copper Sulfate
33		B	♀ 1.054	1.046-1.061 ^b		
34		P	♂ 1.023	1.017-1.028 ^b		
35		P	♀ 1.022	1.018-1.027 ^b		
36		P	♂♀ 1.023	1.018-1.028 ^b		
37		B	♂♀ 1.051 ¹⁴	1.041-1.061 ^b		
38	Sheep	C	1.084	1.080-1.087 ^c	20/4	Benzene-Chloroform
39		P	1.028	1.025-1.029 ^c		

/1/ Referred to water at 40°C or to water at temperature of measurement (T). /2/ Of "packed" cells, not corrected for an estimated 7% of trapped plasma, corrected = 1.098 (1.095-1.101). /3/ Mostly Holstein-Friesian strain /4/ 2.5-18 yrs /5/ 18-30 months. /6/ Mongrels. /7/ 1-3 days. /8/ Angora and Toggenburg strains, 1-2 yrs /9/ Castrated. /10/ CBA strain, 60-80 days. /11/ Duroc-Jersey, Poland-China, Chester White strains. /12/ Sprague-Dawley, 200-250g /13/ Mixed strains, 100-300g. /14/ Cheviot, blackface, grayface strains.

2. RELATIVE VISCOSITIES, BLOOD, PLASMA, SERUM

	Animal	Temperature of Meas. (°C)	Relative Viscosity ¹		
			Blood ²	Plasma ³	Serum ³
	(A)	(B)	(C)	(D)	(E)
1	Man	38	4.7	1.8	1.5
2	Cat	38	4.2		
3	Dog	38	4.7		
4		37	5.5		
5	Goat	20	4.0		
6	Horse	20	4.1	1.9	1.7
7	Ox	20	4.6		
8	Pig	20	5.9		1.6
9	Rabbit	37	3.4		1.4
10	Sheep	20	4.3	1.6	1.5
11	Frog	15	2.8 ⁴		1.5
12	Turtle	20	2.2 ⁴		

/1/ Relative to water at the temperature of measurement. Absolute viscosity = relative viscosity x absolute viscosity of water. Absolute viscosity of water in poises (=dyne-seconds/cm²), accurate to within 2%, is 0.00680 at 38°C, 0.00692 at 37°C, 0.0101 at 20°C, and 0.0114 at 15°C. /2/ Apparent viscosity as measured in capillary tube viscosimeters with radii greater than 0.05cm, length greater than 150 radii, and at apparent Reynolds numbers in the range 50-800 (apparent Reynolds number = ur/ν' where u = mean velocity, r = tube radius, ρ = density, and ν' = apparent viscosity, all expressed in c.g.s. units). Apparent viscosity of blood varies inversely with the temperature of measurement, directly with the protein content, and with the hematocrit. Hematocrits for above values not available in original reports. Hematocrit differences may be the chief reason for variations among species and between the sexes. /3/ Calculated from protein concentration in g/100ml plasma or serum (=c) and fluidity lowering constant (=k) where apparent viscosity = $100/(100-kc)$; k = 5.8 for coordinates 1D, 4.8 for 1E, 7.0 for 6D, 6.1 for 6E, 5.7 for 8E, 5.3 for 9E, 6.5 for 10D, 5.8 for 10E. For values of c, see table on Plasma Proteins, Laboratory and Farm Animals. /4/ Corrected for defibrination (=10% less viscous than whole blood).

3. BLOOD MISCELLANEOUS PHYSICAL PROPERTIES

RBC (C); Plasma (P); Serum (S)

Variable and Animal		Value	Range	Variable and Animal		Value	Range
(A)		(B)	(C)	(A)		(B)	(C)
Electrical charge (millivolts)				Freezing point depression (°C)			
1	Man	C -16.8		19	Man	S -0.562	-0.555 to -0.570°C
2	Cat	C -17.8		20	Dog	S -0.571	
3	Dog	C -21.1		21	Horse	S -0.564	
4	Guinea pig	C -14.2		22	Ox	S -0.585	
5	Monkey, rhesus	C -17.0		23	Pig	S -0.615	
6	Mouse	C -17.9		24	Rabbit	S -0.592	
7	Rabbit	C -7.0		25	Sheep	S -0.619	
8	Rat	C -18.6		26	Fish, pike	S -0.514	
Electrophoretic mobility ¹ (cm ² /volt sec. x 10 ⁻⁴)				27	Fish, plaice	S -0.732	
9	Man	C 1.31		28	Fish, tench	S -0.523	
10	Cat	C 1.39		Refractive index			
11	Dog	C 1.65		29	Man ²	S	1.34920-1.35110°C
12	Guinea pig	C 1.11		30	Fish, cod ³	S	1.34182-1.34249°C
13	Monkey, rhesus	C 1.33		31	Fish, plaice ³	S	1.34165
14	Mouse	C 1.40		32	Fish, tench ³	S	1.34052-1.34237°C
15	Rabbit	C 0.55		Specific heat (gram calories)			
16	Rat	C 1.45		33	Man	P	0.94
Electrical conductivity (Mhos x 10,000)				34	Man	C	0.77
17	Man	S 120	117-124°C	35	Man	P+Q	0.87
18	at 20°C	S 106	105-111°C				

/1/ M/15 phosphate buffer at pH 7.4. /2/ At 17.5°C with Abbe refractometer, refractive index of water being 1.3320. /3/ At 17.5°C with Zeiss Pulfrich refractometer calibrated with distilled water and standard salt solutions at the same temperature.

4. BLOOD¹ COLLOIDS, OSMOTIC PRESSURE

Class		Animal	mm of water ²	
			Value (C)	Range (D)
(A)		(B)		
1	Amphibia	Frog (<i>Rana catesbiana</i>)	103	96-115°C
2		Frog (<i>Rana temporaria</i>)	70	-140°C
3		Toad (<i>Bufo vulgaris</i>)	133	83-242°C
4	Aves	Hen	150	140-160°C
5		Dove	110	80-120°C
6	Elasmobranchs	Dogfish, lesser spotted (<i>Scyllorhinus caniculus</i>) ³		31-36°C
7		Dogfish, smooth (<i>Mustelus mustelus</i>) ³		57-64°C
8		Dogfish, spiny (<i>Squalus acanthias</i>) ³		42-43°C
9		Ray, electric (<i>Torpedo marmorata</i>)		42-52°C
10	Mammalia	Man	330	280-480°C
11		Cat	300	240-330°C
12		Dog	310	230-470°C
13		Goat	300	300-310°C
14		Guinea pig	250	230-280°C
15		Horse	280	230-350°C
16		Ox	280	260-300°C
17		Pig	330	300-350°C
18		Rabbit	290	230-350°C
19		Rat	260	220-290°C
20		Sheep	300	290-340°C
21	Pisces	Carp, common (<i>Cyprinus carpio</i>)	225	100-113°C
22		Eel (<i>Anguilla anguilla</i>) ³	101	112-146°C
23		Pike (<i>Esox lucius</i>)		93-109°C
24		Tench (<i>Tinca vulgaris</i>)		174-250°C
25		Bass (<i>Labrax lupus</i>)	113	112-114°C
26		Cod (<i>Gadus morrhua</i>)		146-173°C
27		Eel, conger (<i>Conger conger</i>) ³		195-213°C
28		Gurnard (<i>Trigla lucerna</i>)	115	196-198°C
29		Mackerel (<i>Scomber scombrus</i>)		107-126°C
30		Plaice (<i>Pleuronectes platessa</i>)	174	181-186°C
31	Reptilia	Scorpion fish (<i>Scorpaena scrofa</i>)		
32		Turbot (<i>Rhombus maximus</i>)		
33	Turtle (<i>Malacoclemmys</i>)	spring ⁴	58	48-68°C
34		fall ⁵	96	81-112°C

/1/ Serum. Variations in osmotic pressure due to differences in temperature of measurement (in the range of 0°-37°C) are generally less than those due to error of measurement. /2/ mm of water/13.546 = mm of Hg. /3/ Original report in literature for 7B = *Scyllium canicula*, for 8B = *Mustelus hinnaulus*, for 9B = *Acanthias vulgaris*, for 23B = *Anguilla vulgaris*, and for 28B = *Conger vulgaris*. /4/ Fasting. /5/ Fed.

5. ERYTHROCYTE SEDIMENTATION RATE, TIME¹

Animal	mm/hr		Method of:		Animal	mm/hr		Method of:
	Value ²	Range ²	(A)	(D)		Value ²	Range ²	
Man			(A)	(D)				(D)
1 Adult			23 Goat			0.50		Reichel
2		♂ 0-8	24 Guinea			1.67	1.25-2	Reichel
3		♀ 0-10	25 pig			1.06	0.75-1.75b	Westergren
4		♂ 0-6	26			1.5		Linzenmeier-Raunert
5		♀ 0-9	27			18		Cutler
6		♂ 0-10	28 Horse			127	119-136	Reichel
7		♀ 0-10	29			69		Linzenmeier-Raunert
8		♂ 0-8	30 Pig			5.35	3-8	Reichel
9		♀ 0-8	31			5		Linzenmeier-Raunert
10		♂ 0-15	32 Westergren			1.05		Wintrobe
11		♀ 0-20	33 Rabbit			2	1.5-2.5	Reichel
12		♂ 0-9	34			2		Linzenmeier-Raunert
13		♀ 0-15	35 Rat			♂ 0.7		Cutler
14 Child	8.6	4-13	36			♀ 1.8		
15	9.13	3-13	37 Sheep			0.55	0.5-0.75	Reichel
16 Cat	7.30	4-13	38			0.5		Linzenmeier-Raunert
17	1	1-1.8	39			3.75	2-6	Reichel
18 Cattle	1	1-1.4	40 Fowl			4		Linzenmeier-Raunert
19		♂ 1-4	41 Goose			3.42	2.75-4	Reichel
20		♀ 1-52	42 Man				6-10 hrs. ⁶	
21 Dog	2		43 Guinea			60 hrs. ⁶		Linzenmeier
22	4	2, 5-5	44 pig				17-42 hrs. ⁶	
			Rabbit					

/1/ Increased during infections, diseases associated with inflammation and tissue injury, with hemodilution; decreased with hemoconcentration. /2/ Measured at the end of the first hour; rate is usually unchanged within the first hour; rates in succeeding hours decrease asymptotically. /3/ 12 days-14 yrs; capillary blood. /4/ 11-56 days pregnant. /5/ No change after thyroidectomy. /6/ Sedimentation time.

6. ERYTHROCYTE FRAGILITY: MAN

Venous Blood (Bv), Oxygenated Blood (Bo), Cutaneous Blood (Bc)

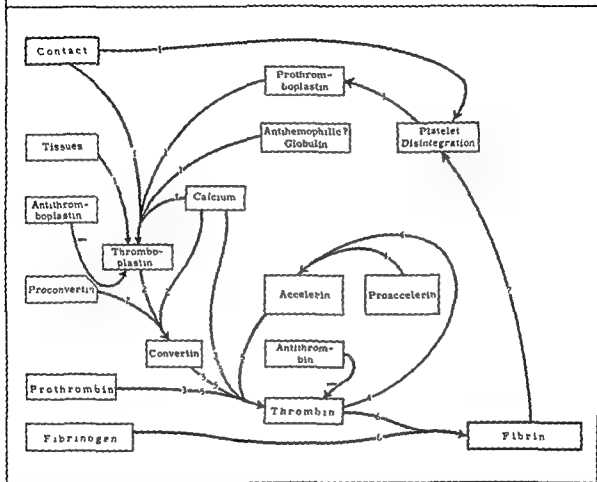
Anticoagulant	Temperature (°C)	Dilution of Blood ¹	Duration of Hemolysis	% NaCl Solution (g NaCl/100 ml)			Method ■ Determining Degree of Hemolysis
				for 10% Hemolysis	for 50% Hemolysis	for 90% Hemolysis	
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)
1 Waxed tube		1 in 26	20 min	Bo 0.43 ²	0.38 ²	0.36 ²	Hemoglobin liberated
2 No anticoagulant		1 in 200	30 min	Bc 0.47 ²	0.43 ²	0.40 ²	RBC count
3 Oxalate	Rm temp	1 in 201	30 min	Bv 0.46 ²	0.41 ²	0.37 ²	Hemoglobin liberated
4 Oxalate	37	1 in 41 ³	30 min	Bv 0.46 ²		0.22 ²	Hemoglobin liberated

/1/ Volume of blood in volume of total mixture of blood and hemolyzing solution. /2/ Estimated from graphs. /3/ Washed cells. /4/ Hemolysis "starts" at. /5/ Hemolysis "complete" at.

7. ERYTHROCYTE FRAGILITY: VERTEBRATES OTHER THAN MAN

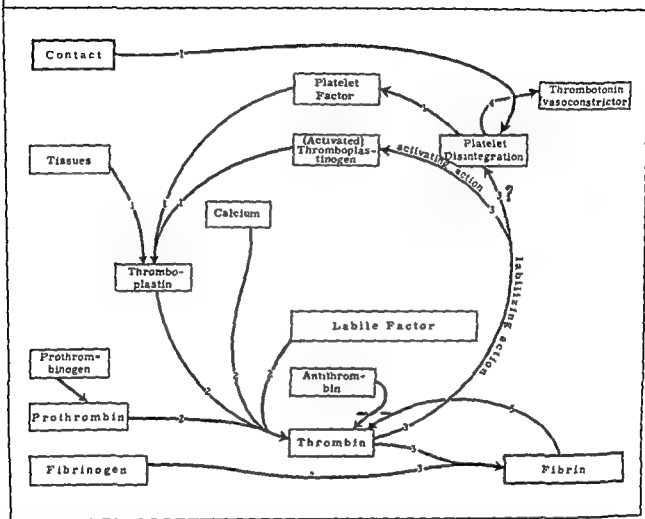
Animal	%NaCl Solution (g/100ml)		Animal	%NaCl Solution (g/100ml)	
	for Initial Hemolysis	for Complete Hemolysis		for Initial Hemolysis	for Complete Hemolysis
(A)	(B)	(C)	(A)	(B)	(C)
1 Baboon		0.18	12 Llama	0.17	0.03
2 Camel		0.26	13 Marmoset		0.40
3 Cat	0.69	0.50	14 Mouse	0.54	0.33
4 Kitten	0.58	0.47	15 Ox	0.59	0.42
5 Chimpanzee		0.28	16 Pig	0.74	0.45
6 Dog	0.45	0.36	17 Rabbit	0.57	0.45
7 Dromedary	0.17	0.07	18 Rat	0.48	0.38
8 Goat	0.62	0.48	19 Sheep	0.60	0.45
9 Guinea pig	0.45	0.33	20 Lamb	0.69	0.48
10 Horse	0.59	0.39	21 Chicken	♂ 0.40	0.32
11 Lemur		0.42	22	♀ 0.41	0.28

8. BLOOD COAGULATION: Theory of P.A. Owren (1952)



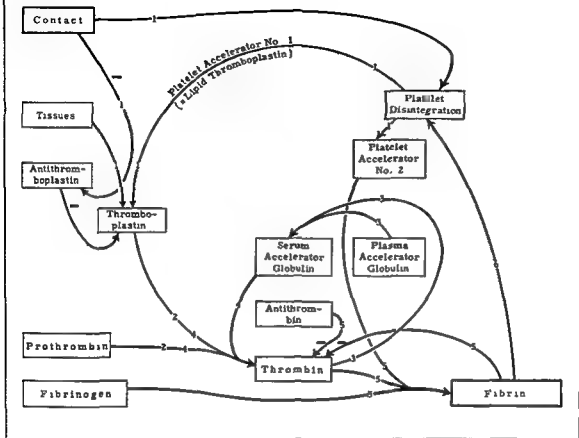
- /1/ Tissue injury yields thromboplastin directly, while contact causes disintegration of platelets and release of prothromboplastin, which is activated by contact, "antihemophilic globulin" and calcium to give thromboplastin.
 /2/ Thromboplastin and proconvertin in the presence of calcium form convertin. An anticonvertin probably exists which opposes the activity of convertin. /3/ Convertin together with calcium brings about a minimal conversion of prothrombin to thrombin. /4/ This initially formed thrombin starts the accelerator system, i.e., the conversion of proaccelerin to accelerin. /5/ Accelerin accelerates the conversion of prothrombin to thrombin in the presence of convertin and calcium. /6/ Thrombin is now in sufficient quantity to convert fibrinogen to fibrin. /7/ Fibrin provokes the disintegration of the platelets with further release of thromboplastic substances already mentioned.

9. BLOOD COAGULATION: Theory of A. J. Quick (1952)



/1/ Thromboplastin is (a) released directly by injured tissue and is also (b) formed by the interaction of plasma thromboplastinogen and a platelet factor, the latter released from disintegrating platelets. /2/ Thromboplastin, prothrombin, calcium, and a labile factor, interact stoichiometrically to form thrombin. In human blood part of the prothrombin is in an inactive form, prothrombinogen. On contact with a rough surface it becomes activated. /3/ The thrombin formed not only converts fibrinogen to fibrin, but activates thromboplastinogen and thereby probably brings about the lysis of platelets and initiates the chain reaction. /4/ The platelets also release a vasoconstrictor, thrombotonin, under the labilizing action of thrombin. The resulting local vasoconstriction aids in the hemostatic process. /5/ The prompt removal of thrombin by fibrin holds in check the autocatalytic reaction mediated through the action of thrombin on platelets and thromboplastinogen.

12. BLOOD COAGULATION: Theory of L. M. Tocantins (1952)



/1/ Contact of the blood with certain surfaces (damaged blood vessel endothelium, glass) initiates the first changes

12. the conversion of inactive plasma accelerator globulin to active serum accelerator globulin. /4/ Thromboplastin together with serum accelerator globulin causes acceleration of the conversion of prothrombin to thrombin. /5/ Some of the thrombin may be inactivated by antithrombin. The thrombin that escapes such inactivation acts, with the aid of platelet accelerator No. 2, to cause the conversion of fibrinogen to fibrin. Some of the excess thrombin is removed from the plasma by adsorption on fibrin. /6/ Fibrin probably causes further disintegration of platelets.

13. BLOOD COAGULATION TIME: MAN

Venous Blood (Bv); Cutaneous Blood (Bc); Venous Plasma (Pv)

Method	Temperature (°C)	Clotting Time ¹ Minutes		Method of:
		Value	Range	
(A)	(B)	(C)	(D)	(E)
1 ml blood in tube	Rm. Temp.	Bv 6.5 Bc 3.0	5-8 2-4	Lee and White
	37	Bv 11.5	7-15 ^b	Tocantins
	Rm. Temp.	Bv 8.9 Bv 7.5	3.5-14.3 ^b 4.7-10.4 ^b	Aggeler and Lucia
2 ml blood in each of 2 tubes	25	Bv	10.5-19.5	Lewis
	29	Bv	6.5-14.5	
	37	Bv	5.5-12.5	
	45	Bv	5-9.5	
1 ml blood in each of 4 tubes	Rm. Temp.	Bv 11.0	5-20	Copley and Houlhan
1 ml blood in paraffined tube	37	Bv 29.3	16-43 ^b	Tocantins
1 ml blood in siliconed tube		Bv	22-61	Lewis
2 ml blood in each of 2 lusteroid tubes	37	Bv	25-50	Diggs
Bead of blood on platinum wire	37	Bc	1.5-2	Gibbs
Blood in 5 fine capillary tubes ⁴	37	Bc	3-7	
0.1 ml oxalated plasma + CaCl ₂ in each of 2 tubes	37	Pv	1.5-2.3 ^{2,3}	Quick
0.2 ml oxalated plasma + CaCl ₂ in each of 2 tubes	23-26	Pv	5.3 ²	Cheney
0.6 ml oxalated plasma + CaCl ₂ in tube	37	Pv	2.72, 5	Nygaard

/1/ Time varies with method; shortened by agitation, high temperature, uncoated glass, rapid vs slow centrifugation, etc. /2/ "Plasma recalcification time," "coagulation time of recalcified plasma."

/3/ Tube centrifuged at 1000 rpm should not clot more than 15 sec sooner than tube centrifuged at 3000 rpm. /4/ Tubes broken to read end point. /5/ Photoelectric end point reading.

14. HEPARIN-RETARDED BLOOD COAGULATION TIME: MAN

Venous Blood (Bv)

Method		Temperature	Heparin added μ g	Clotting Time Minutes		Method of:
				Value	Range	
(A)		(B)	(C)	(D)	(E)	(F)
1	1 ml blood + heparin in tube	Rm. Temp.	1	Bv	8-16	de Takats
2			4	Bv 25	20-28 ^c	
3			0.8 ¹	Bv 18	10-25	
4			1.5 ¹	Bv 28	19-38	
5	1 ml blood + heparin in tube	Rm. Temp.	2.3 ¹	Bv 38	29-52	Waugh and Ruddick
6			3.1 ¹	Bv 48	35-60	
7			3.8 ¹	Bv 57	43-70	
8			4.6 ¹	Bv 64	52-83	
9			5.4 ¹	Bv 71	64-88	
10	1 ml blood + heparin in tube	Rm. Temp.	10	Bv	40-60	Tuft and Rosenfield

/1/ Originally reported in Toronto units. 1 μ g = 0.13 units.

15. HEPARIN TOLERANCE: MAN

Venous Blood (Bv)

Method		Temperature ($^{\circ}$ C)	Clotting Time Minutes		Method of:
			Value	Range	
(A)		(B)	(C)	(D)	(E)
1	10 min. after 10 mg heparin intravenously, 1 ml blood in 1 capillary tube ²	37 ¹	Bv	5-7 ^{d3}	de Takats
2	10 min. after 25 mg heparin intravenously, 1 ml blood in 1 tube	37	Bv	40-90 ^{3,4}	Hagedorn and Barker

/1/ Held in palm of hand. /2/ Tube broken to read end point. /3/ Range excludes hypo- and hyper-reactors. /4/ Approx. 88% range.

16. SKIN BLEEDING TIME¹: MAN

Finger (F): Earlobe (E); Forearm, volar surface (Fv)

Method	Wound Depth mm	Bleeding Time Seconds		Method of:
		Value	Range	
(A)	(B)	(C)	(D)	(E)
1 Puncture skin; blood absorbed	3	F;E	60-180	Duke
2 every 15-30 seconds	3-4	Fv	0-450 ²	
3 Puncture skin; immerse wound in physiological saline, 37°C	6	F	17-340 ³	Copley and Lalich
4 Sphygmomanometer cuff	2	Fv	0-384 ^b	Ivy
5 maintained at 40 mm Hg	3-4	Fv	248	
6 pressure; skin puncture;	3	Fv	240 ⁵	
7 blood absorbed every:	3	Fv	0-240 ⁶	

/1/ Depends upon skin temperature, skin circulation, area punctured, thickness of skin, depth of puncture, psychic influences, etc. /2/ In 95% of persons, less than 374 seconds. /3/ In 95% of persons, less than 180 seconds. /4/ Frank bleeding should stop by 360 seconds; blood tinged oozing may last another 360 seconds. /5/ Average of two tests. /6/ Includes 99.54% of persons.

17. BLOOD CLOT RETRACTION VOLUME, TIME: MAN

Variable				Value	Range	Method of:
(A)				(B)	(C)	(D)
1 2 3 4 5	Clot Retraction	Volume %	Extracorporeal clot volume ¹ as % of volume of blood specimen ²	7.9	-4.1 ³ to 19.9 ^b	Aggeler and Lucia
			Expressed serum volume as % of volume of blood specimen ⁴		40-55	Diggs
			Expressed serum volume as % of total serum present in blood specimen ⁵	78.1	62-94 ^b	Tocantins
	Time Minutes		Venous blood in test tube at room temp.		30-60	Diggs
			Drop of blood in castor oil	33	20-45	Hirschboeck

/1/ = "Fluid volume of clot." /2/ The clot exclusive of RBC, WBC, and platelets, after clot retraction at 1 hr at 37°C. /3/ Negative values may occur due to discrepancies between methods of measurement of formed elements vs. total clot volume. /4/ After maximal clot retraction. /5/ Venous blood in paraffin tube, 13 mm diam., at 37°C, 2 hr. Amount of serum initially present calculated from the hematocrit.

18. PLASMA PROTHROMBIN TIME¹: MAN

Venous Blood (Bv); Cutaneous Blood (Bc); Venous Plasma (Pv)

Method	Temperature (°C)	Thromboplastin added	Clotting Time Seconds		Method of:
			Value	Range	
(A)	(B)	(C)	(D)	(E)	(F)
1	37	Rabbit brain ³	Pv	11-12	Quick
2	37	Rabbit brain ⁴	Pv	17-19	Magath and Hurst
3	38.5	Russell viper ⁵ venom + lecithin	Pv	10	Witts and Hobson
4	37	Human brain ³	Pv	11.5	Aggeler and Lucia
5	37	Rabbit brain ³	Pv	24	Shapiro et al
6	Rm. Temp.	Russell viper ⁵ venom	Pv	23	Page and Russell
7	37	Rabbit brain ³	Pv	41	Shapiro et al
8	37	Human brain ³	Pv	28	Aggeler and Lucia
9	37	Human brain ⁵	Pv	16	Kato and Poncher
10	Rm. Temp.	Rabbit brain ³	Bc	20	Karabin and Anderson
11	Rm. Temp.	Beef lung or rabbit brain ⁶	Bc	20-30	Ziffren et al
12	Rm. Temp.	Beef lung or rabbit brain ³	Bv	25-50	

/1/ Results of different methods are not comparable due to differences in concentration of reacting substances. Departures from normal can be adjudged as such only by comparison with normal controls run in the same laboratory. /2/ See also Table 19. /3/ Acetone dehydrated. /4/ Dried at 37°C. /5/ Daboia. /6/ Fresh. /7/ Oxalated plasma diluted with physiological saline. /8/ The authors draw conclusions from the difference between the values for diluted and undiluted plasma.

19. PLASMA PROTHROMBIN, RELATIVE LEVELS^{1,2}: VERTEBRATES

Animal		Two-Stage Test ³ Dog = 100%	Animal		Two-Stage Test ³ Dog = 100%
(A)		(B)	(A)		(B)
1	Man	84 ⁴	6	Rat	95
2	Cat	91	7	Chicken	50
3	Dog	100	8	Turtle	42
4	Guinea pig	53	9	Dogfish	8
5	Rabbit, albino	89	10	Sea bass	31
			11	Stingray	27

/1/ Data inadequate for stable estimate of universe mean. /2/ Dog plasma normally contains approximately 350 units of prothrombin/ml of plasma. A unit of prothrombin = amount required to form 1 unit of thrombin which is the quantity that will cause clotting of 1 ml of standard fibrinogen solution in 15 seconds, under standard conditions. /3/ Method of Warner, Brinkhous and Smith. Oxalated, and diluted venous plasma is defibrinated by precipitation with ammonium sulfate. The prothrombin is converted to thrombin by use of thromboplastins. The thrombin is assayed against a standard fibrinogen solution. Somewhat different relative values are obtained by the Quick one-stage method. /4/ Mean = 294 units/ml; range = 273-325 units/ml.

20. PLASMA ACCELERATOR GLOBULIN, RELATIVE LEVELS^{1,2}: VERTEBRATES

Animal		One-Stage Method ³ Rabbit = 100%	Two-Stage Method ⁴ Dog = 100% ⁵	Animal		One-Stage Method ³ Rabbit = 100%	Two-Stage Method ⁴ Dog = 100% ⁵
(A)		(B)	(C)	(A)		(B)	(C)
1	Man	2	85	11	Rabbit, albino	100	94
2	Cat		80	7	Rat, albino		36
3	Cow	15	74	8	Chicken	5	2
4	Dog	20	100	9	Turtle		2
5	Guinea pig	10	21				

/1/ Data inadequate for stable estimate of universe mean. /2/ =Labile Factor, Proaccelerin (Factor V), or plasma prothrombin conversion factor. /3/ Method of Quick and Stefanini. /4/ Method of Ware and Seegers. /5/ =176 units/ml plasma. A unit of plasma Ac globulin=1000 times the amount that when present in 1 ml of a reacting mixture of prothrombin, thromboplastin, and calcium will reproduce a standard curve of thrombin production.

21. BLOOD PLATELET COUNT: MAN

Arterial blood (Ba); Venous blood (Bv); Cutaneous blood (Bc)

Platelet Count thousands/mm ³				Method of:		
Value		Range				
(A)		(B)		(C)		
1	Ba	♂	350	Direct	Tocantins	
2	Bv	♂	310			150-690
3	Bc	♂	250			180-358
4	Bv	♂	294			204-395
5	Bv	♀	291		214-360	
6	Bc	♂	273		170-313	
7	Bc	♂♀	409		273-545 ^b	
8	Bv	♂	257		140-440 ^b	
9	Bc		716	500-900 ^l	Indirect	Dameshek
10	Bc		234	130-350		Fonio
11	Bc		514	437-586		Olef

/1/ 84% range.

22. BLOOD PLATELET COUNT: LABORATORY, FARM ANIMALS

Animal	Platelet Count thousands/mm ³ blood		Investigator
	Value	Range	
(A)	(B)	(C)	(D)
1 Cat	345	164-500	Field, 1930
2	422		Lawrence & Valentine, 1947
3	493	368-712	Arndt, 1925
4	519	356-760	Weiser, 1922
5 Cattle	684	542-975	Arndt, 1925
6 Calf	490		Mariconda, 1933
7	461 ^{1,2}	188-960 ^c	Tocantins, 1936
8 Dog	467 ³	353-535	Aynaud, 1909
9	492	298-793	Arndt, 1925
10	638 ⁴	584-856	Ledingham, 1915
11 Guinea pig	719 ¹	550-880	Watabiki, 1917
12	783 ^{1,4}	525-900	Tocantins, 1938
13 Horse	335	249-461	Weiser, 1922
14	352	254-560	Hikmet, 1927
15 Monkey ^{1,6}	267	155-424	Krumbhaar & Musser, 1920
16 Mouse	278	246-339	Copley & Robb, 1942
17	987		Jacobson, 1944
18 Pig	403	296-616	Hikmet, 1925
19 Rabbit	533 ¹	170-1,120 ^{c,5}	Casey & Rosahn, 1932
20	536 ⁷	424-586	Aynaud, 1909
21	454 ¹	190-760	Yamamoto, 1933
22	477 ¹	232-641	Shechet et al., 1935
23 Rat	754	702-796	Olson, 1939
24	795	620-950	Ma, 1932
25	800	500-1,000	Creskoff et al., 1942
26	823		Machella L Higgins, 1939
27 Sheep	441	284-659	Ercegovac, 1936

/1/ Direct method. /2/ Venous blood (ear). /3/ Arterial blood (femoral).

/4/ Ear blood. /5/ Estimate "b" of 95% range = 288,000-788,000.

/6/ Finger blood. /7/ Arterial and venous blood.

23. CAPILLARY FRAGILITY¹: MAN Suction Tests and Tourniquet Test

Forearm, outer surface (Fo); Forearm, antecubital space (Fa)

Age			Diameter Skin Area Observed		Pressure Duration	Petechiae first appear at negative pressure, mm Hg.		Method of:
			cm		Minutes	Value	Range	
(A)			(B)		(C)	(D)	(E)	(F)
1	Suction Test ² (Decompression)	All ages (3-90 years)	Fo	1	1	350	100-→500	Dalldorf
2		1 month	Fa	1	1	425 ³		Lindquist
3		6 months	Fa	1	1	188 ³		
4		1 year	Fa	1	1	156 ³		
5		5 years	Fa	1	1	100 ³		
6		10 years	Fa	1	1	96 ³		
7		Adults	Fa	1	1	141	100-200 ⁴	
8		Newborn	Fa	1	1		250-	Frontal:
9		2-10 years	Fa	1	1		200-250	
10		22-36 years	Fa	1	1		150-200	

Applied Pressure mm Hg			Diameter Skin Area Observed		Pressure Duration	Petechiae Count		Method of:
			cm		Minutes	Value	Range	
(A)			(B)		(C)	(D)	(E)	(F)
11	Tourniquet Test ⁵ (Compression)	Negative 200	Fo	1	1		0-10	Aggeler & Lucia
12		Positive 40	Fo		5	0		Diggs
13		50	Fo	5	15		0-4	
14		35;50 ⁶	Fa	6	15			Gothlin
15		[Syst. + Diast.] ⁷	Fo	5	8		0-10 ⁸	Wright & Lillienfeld

/1/ Results vary with thickness, texture, and color of skin and other variables apart from the capillary resistance per se. /2/ Negative pressure applied by suction cup. /3/ Author's "Medianwerte" (derivation of these values obscure). Some hospital patients included. /4/ 94% range. /5/ Sphygmomanometer cuff placed on arm and inflated. /6/ Petechial index = $2 \times$ (count after 35 mm Hg pressure, for 15 min.) plus, after 1 hr. $1 \times$ (count after 50 mm Hg pressure, for 15 min); petechial index = 0-12. /7/ Pressure maintained at the midpoint between systolic and diastolic pressures of the individual. /8/ In 92% of persons, 10 or fewer petechiae; in 60%, none.

24. THE ABO SYSTEM¹ OF BLOOD FACTORS AND THEIR FREQUENCIES²

Blood Groups ³ (Phenotypes ⁴)		Genetic Determinants (Genotypes ⁵)	RBC Agglutino- gens ⁶	Plasma Agglutin- ins ⁸	Reactions between RBC and Antisera		
General	Differ- entiated				Anti-A	Anti-B	Anti-A ₁
O 45%	O 45.00%	O/O 45.00%	O ⁷	Anti-A, Anti-A ₁ & Anti-B	Neg. ⁹	Neg	Neg.
A 41%	A ₁ 31.39%	A ₁ /A ₁ 3.53%	A ₁	Anti-B	Pos. ⁹	Neg.	Pos.
		A ₁ /A ₂ 2.56%					
		A ₁ /O 25.30%					
	A ₂ 9.61%	A ₂ /A ₂ 0.46%	A ₂		Pos.	Neg.	Neg.
		A ₂ /O 9.15%					
B 10%	B 10.00%	B/B 0.72%	B	Anti-A and Anti-A ₁	Neg.	Pos.	Neg.
		B/O 9.28%					
AB 4%	A ₁ B 2.94%	A ₁ /B 2.94%	A ₁ & B	None	Pos.	Pos	Pos.
	A ₂ B 1.06%	A ₂ /B 1.06%	A ₂ & B		Pos.	Pos.	Neg.

/1/ Equivalents in obsolete terminologies of Moss and Jansky are: O = Moss IV, Jansky I; A = Moss and Jansky II; B = Moss and Jansky III; AB = Moss I, Jansky IV. /2/ Expected frequency, observed and calculated for U.S.A. whites.

/3/ Blood groups, named after agglutinogens. Group determined by testing red cells vs. natural antiserum B from group A, and natural antiserum A and A₁ from group B. /4/ Phenotype: the identifiable antigenic make-up of the red cells, dependent on, but not necessarily indicating the complete gene pattern.

/5/ Genotype: make-up of individual in terms of genes derived from parents. Diagonal (/) separates gene contributed by one parent from gene contributed by other parent. /6/ Agglutinin (antigen): Structure on surface (?) of RBC responsible for reaction with corresponding agglutinin in antiserum. /7/ Group O (first characterized as O due to failure of RBC to clump in either anti-A or anti-B sera) has own agglutinin, designated O. /8/ Agglutinin (antibody): Specific substance occurring in plasma, reacts with corresponding agglutinin, to cause agglutination, possibly hemolysis. Anti-O very rare agglutinin, regularly agglutinates RBC of group O and subgroup A₂. /9/ Pos. = agglutination; Neg. = absence of agglutination.

25. THE DISTRIBUTION OF THE ABO BLOOD GROUPS IN VARIOUS POPULATIONS

Population Tested	Number Tested	Group O %	Group A %	Group B %	Group AB %
American Indians	194	98.5	1.5	0	0
Toba (Argentina)	115	23.5	76.5	0	0
Blackfeet (Montana)	310	78.4	20.0	1.6	6.2
Pueblo (New Mexico)	500	34.1	30.8	28.9	0.0
Arabs, Baghdad	805	53.1	44.7	2.1	10.0
Australian Aborigines	1,000	30.0	25.0	35.0	5.1
Chinese, Peiping	1,853	40.0	42.5	12.4	10.5
Denmark	516	26.6	35.7	27.1	7.0
Egypt, Cairo	1,600	46.0	30.0	17.0	3.7
English, Liverpool	1,063	36.3	54.6	5.3	6.9
Eskimos, S.W. Greenland	23,200	34.1	41.0	18.0	6.5
Finns	39,174	36.5	42.5	14.5	0.5
Germans, Berlin	413	36.5	60.8	2.2	8.5
Hawaii	1,000	31.3	19.0	41.2	5.4
Hindus, North	17,157	41.2	39.4	14.0	8.6
Italians	33,834	31.2	38.4	21.8	5.0
Japanese, Tokyo	500	43.2	22.4	29.2	7.1
Negroes, Senegal	763	33.7	38.4	20.8	5.1
Russia	1,200	37.9	46.7	10.3	6.6
Swedes	500	36.8	38.0	18.6	3.7
Turkey, Macedonia	1,003	49.3	26.0	21.0	4.0
U.S.A., Negroes	20,000	45.0	41.0	10.0	
U.S.A., Whites					

26. HEREDITY OF THE ABO BLOOD GROUPS
Application in Disputed Paternity

If Parents' Groups are--	The Children's Groups	
	Can be--	Cannot be--
O and O	O	A, B, AB
O and A	A, O	B, AB
O and B	B, O	A, AB
A and A	A, O ¹	B, AB
A and B	AB, O ³ , A ² , B ¹	None
B and B	B, O ²	A, AB
O and AB	A, B	O, AB
A and AB	A, AB, B ¹	O
B and AB	B, AB, A ²	O
AB and AB	A, B, AB	O

/1/ This type not possible if either parent is genetically A/A. /2/ This type not possible if one parent is genetically B/B. /3/ If one parent was genetically A/O and the other B/O, an O can result.

27. HEREDITY OF THE ABO SUBGROUPS
Application in Disputed Paternity

If Parents' Blood Groups and Subgroups are--	The Children's Blood Groups and Subgroups	
	Can be--	Cannot be--
A ₁ and O	O ¹ , A ₁ , A ₂ ²	B, A ₁ B, A ₂ B
A ₁ and A ₁	O ¹ , A ₁ , A ₂ ³	B, A ₁ B, A ₂ B
A ₁ and A ₂	O, A ₁ , A ₂	B, A ₁ B, A ₂ B
A ₁ and B	O, A ₁ , A ₂ , B, A ₁ B, A ₂ B ²	(None)
A ₁ and A ₂ B	A ₁ , A ₂ , B, A ₁ B, A ₂ B	O
A ₁ B and O	A ₁ , B	O, A ₂ , A ₁ B, A ₂ B
A ₁ B and A ₁	A ₁ , B, A ₁ B, A ₂ B ²	O, A ₂
A ₁ B and A ₂	A ₁ , B, A ₂ B	O, A ₂ , A ₁ B
A ₁ B and A ₂ B	A ₁ , B, A ₁ B, A ₂ B	O, A ₂
A ₁ B and B	A ₁ , B, A ₁ B	O, A ₂ , A ₂ B
A ₁ B and A ₁ B	A ₁ , B, A ₁ B	O, A ₂ , A ₂ B
A ₂ and O	O, A ₂	A ₁ , B, A ₁ B, A ₂ B
A ₂ and A ₂	O, A ₂	A ₁ , B, A ₁ B, A ₂ B
A ₂ and B	O, A ₂ , B, A ₂ B	A ₁ , A ₁ B
A ₂ B and O	A ₂ , B	O, A ₁ , A ₁ B, A ₂ B
A ₂ B and A ₂	A ₂ , B, A ₂ B	O, A ₁ , A ₁ B
A ₂ B and B	A ₂ , B, A ₂ B	O, A ₁ , A ₁ B
A ₂ B and A ₂ B	A ₂ , B, A ₂ B	O, A ₁ , A ₁ B

/1/ O possible here if Blood Group A₁ (in 1st column) is of genotype A₁O. /2/ A₂ possible if the parent of Blood Group A₁ is of the genotype A₁/A₂. /3/ A₂ possible if one parent is of genotype A₁/A₂ and the other parent is A₁/A₂ or A₁O.

28. THE Rh-Hr (CDE-cde) SYSTEM OF BLOOD FACTORS¹ AND THEIR FREQUENCIES

Phenotypes and their Frequencies, ³ Classified by Agglutination Reactions by Antisera			Genotypes		
1 Anti-Serum (Anti-D)	3 Antisera (Anti-C, D, E)	4 Antisera (Anti-C, D, E, c, d, e)	Wasser ² Terminology	Fisher-Race ² Terminology	Calculated Frequencies (%)
Rh ₀ (D) Negative 0.4-14.9%	rh (CDE) 13.4-15.1%	rr $\begin{smallmatrix} + + + + \\ (CDEcde) \end{smallmatrix}$	EE	cde/cde	13.4 — 15.1
	rh' (CDE) 1.1-0.9%	r'r' $\begin{smallmatrix} + + + + \\ (CDEcde) \end{smallmatrix}$	E'E'	Cde/Cde	0.01 — 0.01
	rh'' (CDE) 0.4-0.9%	r''r'' $\begin{smallmatrix} + + + + \\ (CDEcde) \end{smallmatrix}$	E''E''	Cde/cde	1.1 — 0.9
	rh''' (CDE) 0.4-0.9%	r'''r''' $\begin{smallmatrix} + + + + \\ (CDEcde) \end{smallmatrix}$	E'''E'''	cDE/cDE	0.001 — 0.014
	rh'''' (CDE) 0.4-0.9%	r''''r'''' $\begin{smallmatrix} + + + + \\ (CDEcde) \end{smallmatrix}$	E''''E''''	cDE/cde	0.4 — 0.9
	rh'rh'' (CDE) (rh ₁) 0.01-0.005%	r'r'' $\begin{smallmatrix} + + + + \\ (CDEcde) \end{smallmatrix}$	E'E''	Cde/cDE	0.001 — 0.001
	rh'rh''' (CDE) (rh ₂) 0.01-0.005%	r'r''' $\begin{smallmatrix} + + + + \\ (CDEcde) \end{smallmatrix}$	E'E'''	CDE/cDE	0.001 — 0.001
Rh ₀ (D) Positive 85.1-85.1%	Rh ₀ (CDE) 2.5-2.1%	R ₀ R ₀ $\begin{smallmatrix} + + + + \\ (CDEcde) \end{smallmatrix}$ R ₀ r $\begin{smallmatrix} + + + + \\ (CDEcde) \end{smallmatrix}$	R ⁰ R ⁰ R ⁰ r	cDe/cDe cDe/cde	0.1 — 0.07 2.4 — 2.0
	Rh ₁ (CDE) 31.3-33.0%	H ₁ H ₁ $\begin{smallmatrix} + + + + \\ (CDEcde) \end{smallmatrix}$	R ¹ R ¹	CDe/CDe	16.9 — 17.7
		H ₁ r' $\begin{smallmatrix} + + + + \\ (CDEcde) \end{smallmatrix}$	R ¹ r'	CDe/Cde	1.1 — 0.8
		H ₁ R ₀ $\begin{smallmatrix} + + + + \\ (CDEcde) \end{smallmatrix}$	R ¹ R ⁰	CDe/cDe	2.4 — 2.2
		H ₁ r $\begin{smallmatrix} + + + + \\ (CDEcde) \end{smallmatrix}$	R ¹ r R ¹ r'	CDe/cde CDe/Cde	30.6 — 32.7 0.05
	Rh ₂ (CDE) 16.5-14.1%	R ₂ H ₂ $\begin{smallmatrix} + + + + \\ (CDEcde) \end{smallmatrix}$	R ² R ²	cDE/cDE	2.7 — 2.0
		R ₂ r' $\begin{smallmatrix} + + + + \\ (CDEcde) \end{smallmatrix}$	R ² r'	cDE/cDE	0.2 — 0.3
		R ₂ R ₀ $\begin{smallmatrix} + + + + \\ (CDEcde) \end{smallmatrix}$	R ² R ⁰	cDE/cDe	1.1 — 0.7
		R ₂ r $\begin{smallmatrix} + + + + \\ (CDEcde) \end{smallmatrix}$	R ² r R ² r'	cDE/cde cDe/cDE	12.5 — 11.0 0.04
	Rh ₃ (CDE) 14.9-13.6%	R ₃ H ₃ $\begin{smallmatrix} + + + + \\ (CDEcde) \end{smallmatrix}$	R ³ R ³	CDE/cDe	13.9 — 11.9
		R ₃ r' $\begin{smallmatrix} + + + + \\ (CDEcde) \end{smallmatrix}$	R ³ r'	CDE/Cde	0.05 — 0.20
		R ₃ R ₀ $\begin{smallmatrix} + + + + \\ (CDEcde) \end{smallmatrix}$	R ³ R ⁰	CDE/cDe	0.001 — 0.001
		R ₃ r $\begin{smallmatrix} + + + + \\ (CDEcde) \end{smallmatrix}$	R ³ r R ³ r'	CDE/cDE CDE/CDE	0.01 — 0.07 0.004 — 0.004
	Rh ₄ (CDE) 14.9-13.6%	R ₄ H ₄ $\begin{smallmatrix} + + + + \\ (CDEcde) \end{smallmatrix}$	R ⁴ R ⁴	CDE/CDE	0.001 — 0.001
		R ₄ r' $\begin{smallmatrix} + + + + \\ (CDEcde) \end{smallmatrix}$	R ⁴ r'	CDE/CDE	0.001 — 0.001
		R ₄ R ₀ $\begin{smallmatrix} + + + + \\ (CDEcde) \end{smallmatrix}$	R ⁴ R ⁰	CDE/cDe	0.001 — 0.001
		R ₄ r $\begin{smallmatrix} + + + + \\ (CDEcde) \end{smallmatrix}$	R ⁴ r R ⁴ r'	CDE/cDE CDE/CDE	0.001 — 0.001 0.001 — 0.001

/1/ Note Plus (+) indicates agglutination by antiserum. Thus C = agglutination of red cells by anti-C (anti-c) and c = agglutination of red cells by anti-c (anti-C).

29. THE DISTRIBUTION OF THE Rh-Hr BLOOD TYPES IN VARIOUS POPULATIONS

Population Tested	No. of Persons Tested	Rh Positive						Rh Negative			
		Rh1		Rh2		Rh1 Rh2	Rh1 Rh2 %	rh'		rh''	
		Rh1 Rh1 %	Rh1 rh %	Rh1 Rh1 %	Rh1 rh %			rh %	rh' %	rh'' %	rh' rh'' %
American Indians	95										
Mexico	105	1.1	40.7	7.4	9.5	38.1	3.1	0.0	0.0	0.0	0.0
Oklahoma	104	2.9	34.3	5.7	17.1	36.2	2.9	0.0	0.9	0.0	0.0
Ute	156	0.0	33.7		28.8	37.5	-	7.1	2.6	0.0	0.0
Asiatic Indians	100	1.9	70.5	14.0	5.1	12.8	6.0	0.0	1.0	0.0	0.0
Australian, Aborigines	350	4.0	39.0	54.0	21.0	15.0	-	14.9	0.9	0.0	0.0
Australian, Whites	132	0.6	60.6	35.2	12.6	16.6	-	1.5	0.0	0.0	0.0
Australian, Whites	927	0.9	19.7	34.9	3.0	13.6	0.1	14.8	0.7	1.3	0.0
Chinese	315	2.5	87.0	87.0	19.7	44.4	-	0.0	0.0	0.0	0.0
England, Whites	100	1.0	34.9	35.2	2.0	11.0	-	0.0	1.5	0.0	0.5
Eskimos	200	0.0	51.5	51.5	12.3	17.7	0.0	0.0	0.0	0.0	0.7
Esquimos	200	1.5	74.0	74.0	2.5	22.5	-	0.0	0.0	0.0	0.0
Filipinos	200	0.5	37.4	37.4	13.3	47.3	3.0	1.3	0.0	0.0	0.0
Holland, Whites	200	0.0	89.0	4.0	0.0	4.0	-	0.0	0.0	0.0	0.0
Holland, Whites	150	0.0	39.1	39.1	19.6	14.0	-	0.0	0.0	0.0	0.0
Indonesians	100	0.0	39.1	39.1	15.0	12.9	-	10.1	1.7	0.5	0.01
Japanese	179	15.1	53.5	53.5	14.9	13.9	-	14.7	1.1	0.6	0.0
Papuan	7,317	2.2	20.9	33.8	22.4	5.4	0.1	12.5	0.9	0.5	0.0
Puerto Ricans	766	2.2	20.2	20.2	22.8	4.4	-	8.1	2.7	0.0	0.0
U.S.A., Whites	223	41.2	45.9	0.9	16.3		0.0	7.4	1.5	0.7	0.0
U.S.A., Negroes	135										
U.S.A., Negroes											

30. THE MNS SYSTEM OF BLOOD FACTORS AND THEIR FREQUENCIES¹

Blood Types ² (Phenotypes)		Genetic Determinants (Genotypes) ³	RBC Agglutino- gens ⁴	Reactions between RBC and Antisera ⁵		
General	Differ- entiated			Anti-M	Anti-N	Anti-S
M 28.53%	Ms 7.74%	Ms/Ms 7.74%	M and s	Pos. ⁶	Neg. ⁶	Neg.
	MS 20.79%	MS/Ms 14.26%	M, S and s	Pos.	Neg.	Pos.
		MS/MS 6.53%	M and S			
N 21.68%	Ns 14.78%	Ns/Ns 14.78%	N and s	Neg.	Pos.	Neg.
	NS 6.90%	NS/Ns 6.24%	N, S and s	Neg.	Pos.	Pos.
		NS/NS 0.66%	N and S			
	MNs 21.45%	Ms/Ns 21.45%	M, N and s	Pos.	Pos.	Neg.
MN 49.80%	MNS 28.35%	MS/Ns 19.68%	M, N, S and s	Pos.	Pos.	Pos.
		Ms/NS 4.52%	M, N, S and s			
		MS/NS 4.15%	M, N and S			

/1/ Expected frequency, calculated for English whites. /2/ MNS system is independent of the ABO system. A person of group O, for example, may belong to type M, or N, or MN. Types take names after agglutinogens. M and N determined by testing red cells against induced antisera prepared by immunizing rabbits against red cells of known type. S types determined by testing blood with selected human sera containing anti-S. /3/ Diagonal (/) separates gene contributed by one parent from gene contributed by other parent. /4/ M, N, and S are relatively weak antigens in man. S is a property believed very closely linked, genetically, to the M-N alleles. s is assumed but has not been demonstrated with a specific antiserum, therefore, the S/s genotype (e.g., MS/NS) can be distinguished from the S/S genotype (e.g., MS/MS) only by family studies. /5/ Natural anti-M and anti-N occur rarely. Anti-S has not been identified as a natural agglutinin and has not been produced in animals. Anti-M and anti-N typing sera obtained by immunizing rabbits with human type M and type N cells, respectively. /6/ Pos. = agglutination, Neg. = absence of agglutination.

**31. THE DISTRIBUTION OF THE MN BLOOD FACTORS
IN VARIOUS POPULATIONS**

Population	No. Tested	Frequency of Types, %		
		M	N	MN
Ainu	504	17.9	31.9	50.2
American Indians				
U.S.A. ¹	205	60.0	4.9	35.1
Blackfeet	95	54.7	5.3	40.0
Australian				
Aborigines	730	3.0	67.4	29.6
Chinese	1,029	33.2	18.2	48.6
Danes	2,023	29.1	21.4	49.5
Egyptians, Cairo	613	28.3	23.1	48.6
English	1,522	30.5	21.4	48.2
Eskimos				
S.W. Greenland	377	67.6	2.4	30.0
Finns	6,926	42.3	13.7	44.0
French	1,400	30.1	19.8	50.1
Germans	40,255	30.2	19.7	50.0
Hindus	300	42.7	10.7	46.7
Italians	736	28.9	17.1	53.9
Japanese	7,551	29.0	21.1	49.9
Russians	763	32.2	21.2	46.5
Swedes	1,200	36.1	16.9	47.0
U.S.A. Negroes	278	28.4	21.9	49.6
U.S.A. Whites	6,129	29.2	21.3	49.6

/1/ Information on tribe not available.

**32. HEREDITY OF THE MN BLOOD FACTORS:
Application in Disputed Paternity**

If Parents' Factors are--	The Children's Factors	
	Can be--	Cannot be--
MN and MN	M, N, MN	None
MN and M	M, MN	N
MN and N	N, MN	M
M and N	MN	M, N
M and M	M	N, MN
N and N	N	M, MN

33. THE K ("KELL-CELLANO") SYSTEM OF BLOOD FACTORS AND THEIR FREQUENCIES¹

Blood Factors (Phenotypes)			Genetic Determinants (Genotypes) ²	RBC Agglutin- ogens ³	Reactions between RBC and Antisera ⁴	
					Anti- Kell (Anti-K)	Anti- Cellano (Anti-k)
Cellano Negative 0.2- 0.27%	Kell Positive 8.8-10.17%	KK	K/K 0.2-0.27%	K	Pos. ⁵	Neg. ⁵
Cellano Positive 99.8-99.73%		Kk	K/k 8.6-9.90%	K and k	Pos.	Pos.
		kk	k/k 91.2-89.83%	k	Neg.	Pos.

/1/ The first % = frequency of occurrence among U.S.A. whites; the second, among English whites. /2/ Diagonal (/) separates gene contributed by one parent from gene contributed by the other parent. /3/ The Kell-Cellano factors named after the patients from whom the agglutinins were first obtained. /4/ No natural agglutinins have been found in man, nor have agglutinins been obtained from animals. Antisera for typing are prepared by absorption of unwanted agglutinins (as anti-A and anti-B) with red cells containing A and/or B, or by use of saliva or other A and B containing substances. Since K/K individuals are rare, anti-k is difficult to obtain. Only one example of anti-k has been found, the result of active immunization of a K/K woman by her K/k infants, causing her to develop k antibodies. Many examples of anti-K are known. /5/ Pos. = agglutination; Neg. = absence of agglutination.

**34. THE Le ("LEWIS") SYSTEM OF BLOOD FACTORS
AND THEIR FREQUENCIES¹**

Blood Factors (Phenotypes)		Genetic Determinants (Genotypes ²)	RBC Agglutino- gens	Reactions between RBC and Antisera ⁴	
				Anti-Le ^a	Anti-Le ^b
Lewis positive 20.5%	Le(a+b-)	Le ^a /Le ^a	Le ^a	Pos. ⁵	Neg. ⁵
Lewis negative 79.5%	Le(a-b+)	Le ^a /Le ^b	Le ^b and Le ^{a3}	Neg.	Pos.
		Le ^b /Le ^b	Le ^b	Neg.	Pos.
	Le(a-b-)	?	?	Neg.	Neg.

/1/ Frequency observed for U.S.A. whites. /2/ Le^a = "Lewis" (Mourant) = L₁ (Andresen); Le^b = L₂ (Andresen). Diagonal (/) separates gene contributed by one parent from gene contributed by other parent. /3/ Le^a may be present; thus far available antisera do not detect it. Some persons negative to both anti-Le^a and Le^b, indicating the possible existence of a third, fairly common allele. /4/ All Anti-Lewis agglutinins are believed to be naturally occurring, but they are not common, and have not been obtained from animals. Typing sera are prepared by absorption of unwanted agglutinins (as anti-A and anti-B) with red cells containing agglutinogens A and/or B. /5/ Pos. = agglutination; Neg. = absence of agglutination.

**35. THE Lu ("LUTHERAN") SYSTEM OF BLOOD FACTORS
AND THEIR FREQUENCIES¹**

Blood Factors (Phenotypes)		Genetic Determinants (Genotypes ²)	RBC Agglutino- gens ³	Reactions ⁴ between RBC and Anti-Lu ^a
Lutheran positive 8.0%	Lu (a+)	Lu ^a /Lu ^a 0.2%	Lu ^a	Pos. ⁵
		Lu ^a /Lu ^b 7.8%	Lu ^a and Lu ^b	Pos.
Lutheran negative 92.0%	Lu (a-)	Lu ^b /Lu ^b 92.0%	Lu ^b	Neg. ⁵

/1/ Expected frequency, observed and calculated for English whites, U.S.A.: Lu-positive, 19.1%; Lu-negative, 80.9%. /2/ Diagonal (/) separates gene contributed by one parent from gene contributed by other parent. /3/ Lu^b is assumed but has not been demonstrated with specific antiserum. /4/ No natural agglutinins have been found, but have been produced by deliberate transfusion. Anti-Lu^a has not been obtained from animals. Antisera prepared by absorption of unwanted agglutinins (as anti-A and anti-B) with red cells containing agglutinogens A and/or B. Donors whose sera contain agglutinins due to previous sensitization are very rare. /5/ Pos. = agglutination; Neg. = absence of agglutination.

**36. THE P SYSTEM OF BLOOD FACTORS
AND THEIR FREQUENCIES¹**

Blood Factors (Pheno-types) ²		Genetic Determinants (Geno-types) ³	R B C Agglutinogens	Plasma Agglutinins ⁴	Reactions ⁵ between R B C and Anti-P
P Positive 71.4%	PP	P/P 21.6%	P	?	Pos. ⁶
	Pp	P/p 49.8%	P & p	?	Pos.
P Negative 28.6%	pp	p/p 28.6%	p	Anti-P ⁴	Neg. ⁶

/1/ Expected frequencies calculated for U.S.A. whites.

/2/ p is assumed, but has not been demonstrated with a specific antiserum. /3/ Diagonal (/) separates gene contributed by one parent from that contributed by other parent.

/4/ Anti-P is found occasionally, in very low titre, in P-negative individuals. It has been assumed to be a naturally occurring agglutinin and has frequently been obtained from normal animals. /5/ Typing sera are prepared by absorption of unwanted agglutinins (as anti-A and anti-B) with red cells containing agglutinogens A and/or B. /6/ Pos. = agglutination; Neg. = absence of agglutination.

37. BLOOD ERYTHROCYTE VALUES: MAN

Variable			Value	Range	Variable			Value	Range
(A)			(B)	(C)	(A)			(B)	(C)
1	RBC Count			σ 5.4	4.6-6.2 ^b	RBC Sedimentation Rate (mm/hr)	Westergren Method	σ 0-15	
2	(millions/mm ³ blood)			σ 4.8	4.2-5.4 ^b			σ 0-20	
3				σ 5.1	4.2-6.2 ^b				
4	RBC Packed Volume ¹			σ 47.4	40-54 ^b	Wintrobe Method		σ 0-9	
5	(Hematocrit)			σ 42.4	37-47 ^b			σ 0-15	
6	(ml/100 ml blood)			σ 44.5 ²					
7	Blood Hemoglobin Concentration			σ 15.8	14.0-18.0 ^b	Cutler Method		σ 0-8	
8	(g/100 ml blood)			σ 13.9	11.5-16.0 ^b			σ 0-10	
9	RBC Hemoglobin Concentration			σ 14.9					
10				σ 33.5 ⁴	30-40 ^b	Daland & Worthley Method	Initial Final	σ 0.47	0.48-0.46
11								σ 0.27	0.30-0.26
12									
13						RBC Fragility (% NaCl Solution)	Giffon & Sanford Method	Initial Final	σ 0.44-0.42
14									
15	Corpuscle ³ Thickness			σ 2.06	1.7-2.2 ^b		Parpart Method Mean		σ 0.43
16	(μ)			σ 2.4					
17	Corpuscle ³ Surface Area			σ 135 ⁷	129-146 ^b	Erythrocyte Charge ¹⁴		σ -16.8	
18	(μ ²)			σ 163					
19	Corpuscle ^{2,3,4} Volume (μ ³)			σ 87	70-94 ^{8,9}	Electrophoretic Mobility ¹⁶	(cm ² /volt sec.)	σ 1.31 × 10 ⁻⁴	
20				σ 87	74-98 ^{8,9}				
21				σ 87					
22	Corpuscle ³ Mass ⁹			σ 96	77-103 ^b	Erythrocyte pH		σ 7.24	7.21-7.26
23	(μg)								
24	Corpuscle Specific Gravity ¹⁰			σ 1.0983	0.95-1.101 ^b	Erythrocyte Life Span ¹⁵	(days)	σ 120	σ 109
25					σ 115				
26	Corpuscle ³ Hemoglobin Content (μg)			σ 29	25-34 ^b	RBC (number/mm ³ blood)		σ 45,000	σ 40,000
27				σ 29	23-35 ^b				
28	Corpuscle ³ Iron ¹¹ Content (μg)			σ 0.10	0.08-0.12 ^b	RBC (millions/kg body wt)		σ 3,500	σ 2,630
29									
30	RBC Volume Coefficient ¹²			σ 43.5		RBC blood equiv (ml blood/kg body wt)		σ 0.65	σ 0.55
31	(ml RBC / 100 ml blood, 3 million count)			σ 43.7					
32	RBC Hemoglobin Coefficient ¹²			σ 14.6		HBC & Hb replaced (% of total)		σ 0.83	
33	(g/100 ml blood, 3 million count)			σ 14.5					
34	Color, Volume and Saturation Index ¹²			σ 1.00	0.85-1.15 ^b	Hemoglobin (g/100 ml blood)		σ 0.13	σ 0.11
35	Corpuscle Spherocytic Index			σ 0.27					

1/1 Centrifuged at 2000 g or over (\approx 3000 rpm) for 10 minutes after attaining constant packed cell volume, Σ = m w r (or, $F = (1.118 \times 10^{-2}) r n^2 m$) where w = angular velocity r = radius of circle of rotation in cm, and n = rpm
2/2 Heparin or other isotonic anticoagulant 3/3 "Mean corpuscular " 4/4 When anticoagulant = 2 mg K oxalate/ml blood, mean and 95% range for 4BC = 45 (40-50), 5BC = 41 (36-45), 10BC = 35 (30-40), 12BC = 34 (30-38)
micromet (13B) by $f = 2\pi(r+t)$
9/9 Calculated from water content of iron is qu
pH 7.4 15/ Use of isotopic nitrogen Other methods in essential agreement

38. BLOOD ERYTHROCYTE, HEMATOCRIT, HEMOGLOBIN AND THROMBOCYTE VALUES, BIRTH TO MATURITY: MAN

Age	Erythrocyte Count		Reticulocyte Count		Eryth. Packed Volume (Hematocrit)		Hemoglobin Concentration		Eryth. Hemo-globin Concn- tent ²		Eryth. Hemo-globin Concn- tration ³		Thrombocyte (Platelet) Count ⁴	
	Value ⁵ (H)	Range ⁶ (C)	Value ⁵ (D)	Range ⁶ (E)	Value ⁵ (F)	Range ⁶ (G)	Value ⁵ (H)	Range ⁶ (I)	Value ⁵ (J)	Range ⁶ (K)	Value ⁵ (L)	Range ⁶ (M)	Value ⁵ (N)	Range ⁶ (O)
1. At birth ⁷	5.7	4.8-7.1 ^c	4.35	2.50-6.50 ^c	56.6	106	21.5	18.0-27.0 ^c	38	38.0	227	140-290 ^c		
2. First Day	5.6	4.7-7.0 ^c	1.12	0.10-4.50 ^c	56.1	106	21.2	17.7-26.5 ^c	38	37.8				
3. End 1st wk.	5.3	4.5-6.4 ^c	0.67	0.20-1.50 ^c	52.7	101	19.6	16.2-25.5 ^c	37	37.2	235	150-320 ^c		
4. End 2nd wk.	5.1	4.3-6.0 ^c	0.63	0.20-1.50 ^c	49.6	96	18.0	14.5-24.2 ^c	35	36.3	247	163-340 ^c		
5. End 3rd wk.	4.9	4.1-6.0 ^c	0.73	0.10-1.00 ^c	46.6	93	16.6	12.0-23.0 ^c	34	35.6	267	177-367 ^c		
6. End 4th wk.	4.7	3.9-5.9 ^c	0.73	0.10-1.00 ^c	44.6	91	15.6	12.0-21.8 ^c	33	35.0	280	185-390 ^c		
7. End 2nd mo.	4.5	3.8-5.8 ^c	1.20	0.50-3.10 ^c	38.9	85	13.3	10.8-18.0 ^c	30	34.2	315	200-428 ^c		
8. End 4th mo.	4.5	3.8-5.3 ^c	1.66	0.90-2.94 ^c	36.5	79	12.4	10.2-15.0 ^c	27	34.0	338	205-465 ^c		
9. End 6th mo.	4.6	3.9-5.3 ^c	1.38	0.72-2.30 ^c	36.2	78	12.3	10.0-15.0 ^c	27	34.0	340	205-470 ^c		
10. End 8th mo.	4.6	4.0-5.4 ^c	1.12	0.65-1.90 ^c	35.8	77	12.1	9.8-15.0 ^c	26	33.8	345	210-475 ^c		
11. End 10th mo.	4.6	4.0-5.5 ^c	0.97	0.62-1.80 ^c	35.5	77	11.9	8.4-14.9 ^c	26	33.5	345	212-470 ^c		
12. End 12th mo.	4.6	4.0-5.5 ^c	0.90	0.60-1.70 ^c	35.2	77	11.6	9.0-14.6 ^c	25	33.0	345	218-470 ^c		
13. End 2nd yr.	4.7	3.8-5.4 ^c			35.5	78	11.7	9.2-15.5 ^c	25	33.0				
14. End 4th yr.	4.7	3.8-5.4 ^c			37.1	80	12.6	9.6-15.5 ^c	27	34.0				
15. End 6th yr.	4.7	3.8-5.4 ^c			37.9	80	12.7	10.0-15.5 ^c	27	33.5				
16. End 8th yr.	4.7	3.8-5.4 ^c			38.9	80	12.9	10.3-15.5 ^c	27	33.2				
17. End 10th yr.	4.8	3.8-5.4 ^c			39.0	80	13.0	10.7-15.5 ^c	27	33.5				
18. End 12th yr.	4.8	3.8-5.4 ^c			39.6	81	13.4	11.0-16.5 ^c	28	33.8				
19. 13 yrs. & over					478.9, 10	873, 10	15.8	14.0-18.0 ^b	29, 10	33.5 ⁹				
20. Males	5.4	4.6-6.2 ^b			428.9, 10	873, 10	13.9	11.5-16.0 ^b	29, 10	33.5 ⁹				
21. Females	4.8	4.2-5.4 ^b			44.5, 8.9	87.9	14.9		29, 10	33.5 ⁹				
22. M & F Av.	5.1	4.2-6.2 ^b	1.5	0.5-3.8 ^c							4094	273-545 ^b		

^{1/1} = Mean Corpuscular Volume (M.C.V.). ^{2/2} = Mean Corpuscular Hemoglobin (M.C.H.). ^{3/3} = Mean Corpuscular Hemoglobin Concentration (M.C.H.C.) in %. ^{4/4} Cateneous blood. Direct method of Wood, Vogel, and Fambulener except 22 LM-direct method of Tees-Ecker. ^{5/5} Smoothed means from plotted curves. ^{6/6} Smoothed sample ranges from plotted curves (except as noted). ^{7/7} If cord clamped after placental separation, average 560,600 more erythrocytes per mm³ and 2.6 g/100ml more hemoglobin during the first week of life than if cord clamped immediately after birth. Also in newborn, heel blood (capillary) higher in erythrocytes and hemoglobin than blood from superior sagittal sinus. ^{8/8} Centrifuged at 2000 g (3000 rpm) or over, for 10 min, after attaining constant packed cell volume. ^{9/9} Heparin or other isotonic anticoagulant. ^{10/10} Estimate ^{10/10} of 95% range: 40-54 for 20F; 37-47 for 21F; 70-94 for 20G; 74-98 for 21G; 25-34 for 20J; 24-33 for 21J; 23-35 for 22J; 30-40 for 22K.

39. BLOOD ERYTHROCYTE AND HEMOGLOBIN VALUES AT OR NEAR SEA LEVEL: MAN ¹				
Country	Place ²	RBC Count millions/mm ³ blood	Blood Hemoglobin Concentration g/100ml blood	Corpuscle Hb Content ³ µg
(A)	(B)	(C)	(D)	(E)
1 U. S.	Portland, Oregon	5.39	15.8	29.3
2 U. S.	Portland, Oregon	5.42	15.8	29.2
3 U. S.	New Orleans	5.85	15.9	27.2
4 U. S.	New Orleans	5.26	15.6	29.7
5 U. S.	Kansas	4.84	15.1	31.2
6 U. S.	Omaha	4.69	15.0	32.0
7 U. S.	Kansas	5.11	15.0	29.4
8 Argentina	Buenos Aires	5.50	15.4	28.0
9 Argentina	Buenos Aires	5.30	14.8	27.9
10 Denmark	Copenhagen	5.07	15.0	29.6
11 Germany	Jena	5.06	16.0	31.6
12 Germany	Giesse	4.96	16.0	32.3
13 Hawaii	Honolulu	5.08	15.1	29.7
14 India	Calcutta	5.36	14.8	27.6
15 India	Bombay	5.11	15.4	30.1
16 Norway	Oslo	5.52	16.2	29.3
17 Peru	Lima	5.26	15.7	29.8
18 Peru	Lima	5.14	16.0	31.1
19 Summary, U. S. ⁴		5.22	15.5	29.7
20 Summary, all countries		5.22	15.5	29.7

/1/ Males. /2/ Altitudes of less than 0.4 Km. /3/ Mean Corpuscular Hemoglobin (M. C. H.).
/4/ For standards see Table 37.

40. BLOOD ERYTHROCYTE AND HEMOGLOBIN VALUES AT ALTITUDE: MAN¹

Residents (R); Sojourners (S).

Country	Place	Altitude Km	RBC Count millions/mm ³ blood	Blood Hemoglobin Concentration g/100ml blood	Corpuscle Hb Content ² µg
(A)	(B)	(C)	(D)	(E)	(F)
1 Sea Level ^{3,4}		<0.4	R 5.22	R 15.5	29.7
2 Argentina	Tucuman	0.4	R 5.31	R 16.1	30.3
3 Canada	Saskatchewan	0.5	R 5.52	R 15.6	28.3
4 Switzerland	Zurich	0.5	R 5.00	R 15.0	30.0
5 U. S.	Denver, Colo.	1.5	R 5.42	R 16.5	30.4
6 So. Africa	Johannesburg	1.8	R 5.99	R 14.7	24.5
7 Mexico	Mexico City	2.3	R 7.35	R 18.4	25.0
8 Mexico	Mexico City	2.3	R 5.38	R 17.7	32.9
9 Chile	Chuquicamata	2.8	S 5.24	S 15.9	30.3
10 Chile	Ollague	3.7	S 5.54	S 17.0	30.7
11 Peru	Oroya	3.7	R 5.67	R 18.8	33.2
12 Argentina	Mina Aguilar	4.5	R 6.46	R 19.4	30.0
13 Peru	Morococha	4.5	R 6.15	R 20.8	33.8
14 Chile	Montt	4.7	S 5.84	S 17.6	30.1
15 Chile	Quilcha	5.3	R 7.37	R 22.6	30.7
16 Chile	Quilcha	5.3	S 5.95	S 18.4	30.9
17 Chile	Punta	6.1	S 5.77	S 18.3	31.7
18 India	Nanga Parbat	7.0	S 8.10	S 24.7	30.5

/1/ Males. /2/ Mean Corpuscular Hemoglobin (M.C.H.). /3/ Altitudes of less than 0.4 Km
/4/ For standards see Table 37.

41. BLOOD ERYTHROCYTE VALUES IN PREGNANCY AND POSTPARTUM: MAN

41. BLOOD ERYTHROCYTE VALUES IN PREGNANCY AND POSTPARTUM: MAN												
Variable		Second Trimester				Third Trimester				During Labor		Postpartum Value and Range
		Value and Range				Value and Range				Value and Range		
		4th Month (B)	5th Month (C)	6th Month (D)	7th Month (E)	8th Month (F)	9th Month (G)	(H)	(I)		(J)	
1	RBC Count (millions/mm ³ blood)	4.5	4.3	4.0	4.0	4.1	4.2	4.2	4.4	4.5	4.8	
2		3.8-5.2b	3.7-5.0b	3.5-4.8b	3.5-4.8b	3.5-4.8b	3.7-5.0b		4.0-5.0b	4.0-5.0b	4.2-5.4b	
3	Packed RBC Volume (Hematocrit) (ml/100 ml blood)	40	39	37	37	37.5	37.5	37.5	39	40	42.5	
4		35-45b	34-44b	32-42b	32-42b	33-43b	33-43b		34-44b	35-45b	37-47b	
5	Blood Hemoglobin Concentration (g/100 ml blood)	12.8	12.2	11.4	11.4	11.6	12.0	12.6	12.6	12.8	13.8	
6		11.4-15.0b	10.8-14.6b	10.2-14.0b	10.2-14.0b	10.4-14.2b	10.8-14.4b	11.2-15.0b	11.4-15.4b	12.0-16.0b		
7	RBC Hemoglobin Concentration (g/100 ml RBC)	32	31	31	31	31	32	32	32	32	32.5	
8	Corpuscle Hemoglobin Content (μg)	28.4	28.4	28.5	28.5	28.3	28.5	28.6	28.4	28.7		
9	Corpuscle Volume (μ ³)	89	91	92	92	91	89	89	89	89	89	

42. BLOOD ERYTHROCYTE VALUES: MAMMALS, LABORATORY

Animal	RBC Count millions/mm ³ blood		Reticulocytes % of total RBC		Corpuscle Diameter μ		Corpuscle Volume μ^3	
	Value	Range	Value	Range	Value	Range	Value	Range
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)
1 Cat	8.0	6.5-9.5	0.2		6.2	5-7.2	57	51-63
2 Dog	6.3	4.5-8	0.7	0-2.7	7.2	5.2-8.0 ²	66	59-68
3 Guinea pig	5.6	4.5-7	0.9	0.4-1.8	7.4 ²	7.0-7.5 ²	77	71-83
4 Mouse	9.3	7.7-12.5	4.0		6.2		49	48-51
5 Rabbit	5.7	4.5-7	2.2	2-3	7.5 ³	6.5-7.5 ²	61	60-68
6 Rat	8.9 ¹	7.2-9.6 ¹	2.9	0.6-4.9	7.5 ³	6.0-7.5 ²	61	57-65

Animal	Packed RBC Volume (Hematocrit) ml/100ml blood		Blood Hemo- globin Conc. g/100ml blood		Corpuscle Hemo- globin Conc. g/100ml RBC		Corpuscle Hemo- globin Content μg	
	Value	Range	Value	Range	Value	Range	Value	Range
(A)	(J)	(K)	(L)	(M)	(N)	(O)	(P)	(Q)
1 Cat	40.0	28-52	11.2	7.0-15.5	28	23-31	14	12-16
2 Dog	45.5	38-53	14.8	11.0-18.0	33	30-35	23	21-25
3 Guinea pig	42.0	37-47	14.4	11-16.5	34	33-35	26	24.5-27.5
4 Mouse	41.5		14.8	10-19	36	33-39	16	15.5-16.5
5 Rabbit	41.5	33-50	11.9	8.0-15.0	29	27-31	21	19-23
6 Rat	46.0 ¹	39-53 ¹	14.8	12-17.5	32	30-35	17	15-19

/1/ More weight given to common strains. /2/ Dry film. /3/ In plasma.

43. BLOOD HEMATOCRIT AND HEMOGLOBIN VALUES: VERTEBRATES¹

Animal		Packed RBC Volume (Hematocrit) ² ml/100ml blood		Blood Hemoglobin Concentration g/100ml blood		RBC Hemoglobin Concentration g/100ml blood
		Value	Range	Value	Range	Value
(A)		(B)	(C)	(D)	(E)	(F)
1	Man	44.5 ⁴		14.95		33.5
2	Chimpanzee	41.5		13.0		31
3	Cow	40	33-47 ^{b3}	11.5	8.7-14.5 ^{b3}	29
4	Goat	34	20-50 ^b	10.6	7.3-14 ^{b3}	31
5	Hamster	46	36-54 ^c	13.9	11-17.4 ^c	30
6	Horse	33.4	28-42 ^{b3}	11.1	8-14 ^{b3}	33
7	thoroughbred	42		13.9		33
8	Monkey, rhesus	42	32-52 ^{b3}	12.6	10-16	30
9	Pig	41.5	30-53 ^{b3}	13.3	10-16.5 ^{b3}	32
10	Sheep	32	22-40 ^{b3}	12.6	10-15.5 ^{b3}	39
11	Chicken	32		11.2 ⁶		35
12	Duck	39.5		14.8	9-21 ^{b3}	37
13	Goose	44		12.8		29
14	Pigeon	42.5		15.3		36
15	Turkey	38		11.2		29
	Fish					
16	carp	31.3	21-40 ^b	10.5	9.4-12.4 ^b	34
17	mackerel	51.5		14.5		28
18	trout	27.2	22-36 ^b	8.5	6.2-11.5 ^b	31
	Frog					
19	Rana catesbeiana	30		7.8		26
20	Rana pipiens				10-12	
21	Snake, garter	28		8.6		31
22	Turtle, box	25	21-27 ^b	7.2	6.1-9.1 ^b	29

/1/ See Table No. 42. /2/ Determined by centrifugation under standard conditions. /3/ Standard deviation from which this range is calculated is from a subgroup whose mean is averaged with one or more others to obtain the value as presented. /4/ Average for both sexes. Hematocrit for males 47, range = 40-54^b; females = 42, range = 37-47^b. /5/ Average for both sexes. Hb for males = 15.8, range = 14-18^b; females = 13.9, range = 11.5-16^b. /6/ Average for both sexes. Hb for cocks = 12.9, hens = 9.4.

44. BLOOD ERYTHROCYTE VALUES: FISH

Animal	RBC Count millions/mm ³ blood	Hematocrit ml/100ml blood	Hemoglobin ¹ g/100ml blood	RBC Diameters μ	RBC Volume μ^3
(A)	(B)	(C)	(D)	(E)	(F)
1 Bullhead (<i>Ameiurus nebulosus</i>)	1.8	26	14.7		311
2 Carp (<i>Cyprinus carpio</i>)	0.84	31	10.5		278-340
3 Range:	0.65-1.13	21-40	9.4-12.4		
4 Dogfish (<i>Mustelus canis</i>)	0.46	23.3	4.6	19.1 x 13.8	541
5 Dogfish (<i>Squalus acanthias</i>)	0.24	18.9	3.8	22.7 x 15.2	820
6 Eel (<i>Anguilla bostoniensis</i>)	2.4	36	9.3	12.3 x 8.1	149
7 Eel pout (<i>Zoarces anguillaris</i>)	2.04	20.8	4.0	10.4 x 8.7	102
8 Goosefish (<i>Lophius piscatorius</i>)	1.09	16.8	4.3	13.3 x 9.6	241
9 Hagfish (<i>Myxine glutinosa</i>)	0.15	22.2	4.6	26.4 x 18.3	1530
10 Lamprey eel (<i>Petromyzon marinus</i>)	0.33	23.5	5.8	14.3	710
11 Mackerel (<i>Scomber scombrus</i>)	3.9	46	14.2	12.0 x 8.3	118
12 Menhaden (<i>Brevoortia tyrannus</i>)	3.2		13.4	9.8 x 7.2	148
13 Pike (<i>Esox lucius</i>)	1.10	27			
14 Range:	0.40-1.37	16-33			
15 Puffer (<i>Sphoeroides maculatus</i>)	4.2		7.4	8.8 x 6.9	77
16 Sea robin, common (<i>Prionotus carolinus</i>)	2.5	24	7.1	9.8 x 6.5	95
17 Sea robin, Northern striped (<i>Prionotus strigatus</i>)	1.93	22.2	6.2	10.4 x 7.3	130
18 Shark sucker (<i>Echeneis naucrates</i>)	3.75	34	10.5	10.9 x 7.0	91
19 Skate, barndoor (<i>Raja stabiuliforis</i>)	0.27	20.0	3.6	21.9 x 15.6	727
20 Skate, clearnose (<i>Raja eglanteria</i>)	0.30	24	4.5	23.7 x 14.4	823
21 Stingray (<i>Dasyatis centroura</i>)	0.30	19	3.0	20.6 x 14.3	612
22 Sturgeon (<i>Acipenser sturio</i>)	0.43	21.5	5.0	14.0 x 9.7	506
23 Tautog (<i>Tautoga onitis</i>)	2.05		6.7	10.8 x 7.3	
24 Trout (<i>Salvelinus fontinalis</i>)	1.01	27	8.5		314
25 Range:	0.74-1.55	22.2-36	6.2-11.5		204-348

¹/ With Sahli hemoglobinometer except 2-3D and 24-25D where Evelyn photoelectric colorimeter was used.

45. ERYTHROCYTE DIAMETERS¹: MAMMALS

[illegible]

46. BLOOD ERYTHROCYTE VALUES IN FETUS, NEWBORN AND ADULT FEMALE: MAMMALS¹

R B C Count (millions/mm³ blood)

Stage of Development	Sex	Man			Cat			Cow			Goat			Pig			Rabbit			Rat			Sheep		
		Value	Range	Mean	Value	Range	Mean	Value	Range	Mean	Value	Range	Mean	Value	Range	Mean	Value	Range	Mean	Value	Range	Mean	Value	Range	Mean
1	Adult	4.8	3.8-5.0	4.4	5.7	3.8-4.1	4.4	5.1	3.7-4.1	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4
2	Newborn	4.8	3.8-5.0	4.4	5.7	3.8-4.1	4.4	5.1	3.7-4.1	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4
3	Adult	4.8	3.8-5.0	4.4	5.7	3.8-4.1	4.4	5.1	3.7-4.1	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4
4	Newborn	4.8	3.8-5.0	4.4	5.7	3.8-4.1	4.4	5.1	3.7-4.1	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4
5	Adult	4.8	3.8-5.0	4.4	5.7	3.8-4.1	4.4	5.1	3.7-4.1	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4
6	Newborn	4.8	3.8-5.0	4.4	5.7	3.8-4.1	4.4	5.1	3.7-4.1	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4
7	Adult	4.8	3.8-5.0	4.4	5.7	3.8-4.1	4.4	5.1	3.7-4.1	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4
8	Newborn	4.8	3.8-5.0	4.4	5.7	3.8-4.1	4.4	5.1	3.7-4.1	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4
9	Adult	4.8	3.8-5.0	4.4	5.7	3.8-4.1	4.4	5.1	3.7-4.1	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4
10	Newborn	4.8	3.8-5.0	4.4	5.7	3.8-4.1	4.4	5.1	3.7-4.1	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4
11	Adult	4.8	3.8-5.0	4.4	5.7	3.8-4.1	4.4	5.1	3.7-4.1	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4
12	Newborn	4.8	3.8-5.0	4.4	5.7	3.8-4.1	4.4	5.1	3.7-4.1	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4

Hematocrit (ml/100ml blood)

Stage of Development	Sex	Man			Cat			Cow			Goat			Pig			Rabbit			Rat			Sheep		
		Value	Range	Mean	Value	Range	Mean	Value	Range	Mean	Value	Range	Mean	Value	Range	Mean	Value	Range	Mean	Value	Range	Mean	Value	Range	Mean
1	Adult	4.8	3.8-5.0	4.4	5.7	3.8-4.1	4.4	5.1	3.7-4.1	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4
2	Newborn	4.8	3.8-5.0	4.4	5.7	3.8-4.1	4.4	5.1	3.7-4.1	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4
3	Adult	4.8	3.8-5.0	4.4	5.7	3.8-4.1	4.4	5.1	3.7-4.1	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4
4	Newborn	4.8	3.8-5.0	4.4	5.7	3.8-4.1	4.4	5.1	3.7-4.1	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4
5	Adult	4.8	3.8-5.0	4.4	5.7	3.8-4.1	4.4	5.1	3.7-4.1	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4
6	Newborn	4.8	3.8-5.0	4.4	5.7	3.8-4.1	4.4	5.1	3.7-4.1	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4
7	Adult	4.8	3.8-5.0	4.4	5.7	3.8-4.1	4.4	5.1	3.7-4.1	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4
8	Newborn	4.8	3.8-5.0	4.4	5.7	3.8-4.1	4.4	5.1	3.7-4.1	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4
9	Adult	4.8	3.8-5.0	4.4	5.7	3.8-4.1	4.4	5.1	3.7-4.1	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4
10	Newborn	4.8	3.8-5.0	4.4	5.7	3.8-4.1	4.4	5.1	3.7-4.1	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4
11	Adult	4.8	3.8-5.0	4.4	5.7	3.8-4.1	4.4	5.1	3.7-4.1	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4
12	Newborn	4.8	3.8-5.0	4.4	5.7	3.8-4.1	4.4	5.1	3.7-4.1	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4

Blood Hemoglobin Concentration (g/100ml blood)

Stage of Development	Sex	Man			Cat			Cow			Goat			Pig			Rabbit			Rat			Sheep		
		Value	Range	Mean	Value	Range	Mean	Value	Range	Mean	Value	Range	Mean	Value	Range	Mean	Value	Range	Mean	Value	Range	Mean	Value	Range	Mean
1	Adult	4.8	3.8-5.0	4.4	5.7	3.8-4.1	4.4	5.1	3.7-4.1	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4
2	Newborn	4.8	3.8-5.0	4.4	5.7	3.8-4.1	4.4	5.1	3.7-4.1	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4
3	Adult	4.8	3.8-5.0	4.4	5.7	3.8-4.1	4.4	5.1	3.7-4.1	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4
4	Newborn	4.8	3.8-5.0	4.4	5.7	3.8-4.1	4.4	5.1	3.7-4.1	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4
5	Adult	4.8	3.8-5.0	4.4	5.7	3.8-4.1	4.4	5.1	3.7-4.1	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4
6	Newborn	4.8	3.8-5.0	4.4	5.7	3.8-4.1	4.4	5.1	3.7-4.1	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4
7	Adult	4.8	3.8-5.0	4.4	5.7	3.8-4.1	4.4	5.1	3.7-4.1	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4
8	Newborn	4.8	3.8-5.0	4.4	5.7	3.8-4.1	4.4	5.1	3.7-4.1	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4
9	Adult	4.8	3.8-5.0	4.4	5.7	3.8-4.1	4.4	5.1	3.7-4.1	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4
10	Newborn	4.8	3.8-5.0	4.4	5.7	3.8-4.1	4.4	5.1	3.7-4.1	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4
11	Adult	4.8	3.8-5.0	4.4	5.7	3.8-4.1	4.4	5.1	3.7-4.1	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4
12	Newborn	4.8	3.8-5.0	4.4	5.7	3.8-4.1	4.4	5.1	3.7-4.1	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4	5.2	3.5-5.0	4.4

^{1/1} Values quoted for adult female are not necessarily those of the mother. Additional values for man may be found in the table on Erythrocyte Values in Pregnancy and Postpartum; ^{1/2} Gestation period for man in days is 280, cat, 60, goat, 147, pig, 114, rabbit, 31, rat, 21; sheep 187. ^{1/3} Cord or venous blood. ^{1/4} Age, 3-12 days. ^{1/5} Probably by caesarian section. ^{1/6} Caesarian section. ^{1/7} Age, 1-12 hrs. ^{1/8} Age, 1-10 days. ^{1/9} Age, 2-18 hrs. ^{1/10} Age 24-48 hrs. ^{1/11} Age, 1-3 days. ^{1/12} Age, 8-16 days.

46. BLOOD ERYTHROCYTE VALUES IN FETUS, NEWBORN AND ADULT FEMALE MAMMALS (Concluded)

Corpuscle Hemoglobin Content (μg)

Stage of Development	Man			Cat			Cow			Goat			Pig			Rabbit			Rat			Sheep		
	Value (V)	Range (R)	Value (V)	Value (V)	Range (R)	Value (V)	Value (V)	Range (R)	Value (V)	Value (V)	Range (R)	Value (V)	Value (V)	Range (R)	Value (V)	Value (V)	Range (R)	Value (V)	Value (V)	Range (R)	Value (V)	Value (V)	Range (R)	
31	III	47-97C		21.3	20.8-22.0C		56	36-37																
32	III	47-97C		21.1	20.0-21.6C		21	18-40																
33	III	38-48C		21.1	20.0-21.6C		23	17-28																
34	III	38-53C		20.8	17.5-23.2C		23	17-28																
35	III	38-48C		17.8	17.4-18.2C		44																	
40	III	38-48C		21	17.5-23.2C		21	18-33																
41	III	24-38C		21	18-33		21	18-33																
42	III	24-38C		21	18-33		21	18-33																
43	III	24-38C		21	18-33		21	18-33																
44	III	24-38C		21	18-33		21	18-33																
45	III	24-38C		21	18-33		21	18-33																
46	III	24-38C		21	18-33		21	18-33																
47	III	24-38C		21	18-33		21	18-33																
48	III	24-38C		21	18-33		21	18-33																
49	III	24-38C		21	18-33		21	18-33																
50	III	24-38C		21	18-33		21	18-33																
51	III	24-38C		21	18-33		21	18-33																
52	III	24-38C		21	18-33		21	18-33																
53	III	24-38C		21	18-33		21	18-33																
54	III	24-38C		21	18-33		21	18-33																
55	III	24-38C		21	18-33		21	18-33																
56	III	24-38C		21	18-33		21	18-33																
57	III	24-38C		21	18-33		21	18-33																
58	III	24-38C		21	18-33		21	18-33																
59	III	24-38C		21	18-33		21	18-33																
60	III	24-38C		21	18-33		21	18-33																
61	III	24-38C		21	18-33		21	18-33																
62	III	24-38C		21	18-33		21	18-33																
63	III	24-38C		21	18-33		21	18-33																
64	III	24-38C		21	18-33		21	18-33																
65	III	24-38C		21	18-33		21	18-33																
66	III	24-38C		21	18-33		21	18-33																
67	III	24-38C		21	18-33		21	18-33																
68	III	24-38C		21	18-33		21	18-33																
69	III	24-38C		21	18-33		21	18-33																
70	III	24-38C		21	18-33		21	18-33																
71	III	24-38C		21	18-33		21	18-33																
72	III	24-38C		21	18-33		21	18-33																
73	III	24-38C		21	18-33		21	18-33																
74	III	24-38C		21	18-33		21	18-33																
75	III	24-38C		21	18-33		21	18-33																
76	III	24-38C		21	18-33		21	18-33																
77	III	24-38C		21	18-33		21	18-33																
78	III	24-38C		21	18-33		21	18-33																
79	III	24-38C		21	18-33		21	18-33																
80	III	24-38C		21	18-33		21	18-33																
81	III	24-38C		21	18-33		21	18-33																
82	III	24-38C		21	18-33		21	18-33																
83	III	24-38C		21	18-33		21	18-33																
84	III	24-38C		21	18-33		21	18-33																
85	III	24-38C		21	18-33		21	18-33																
86	III	24-38C		21	18-33		21	18-33																
87	III	24-38C		21	18-33		21	18-33																
88	III	24-38C		21	18-33		21	18-33																
89	III	24-38C		21	18-33		21	18-33																
90	III	24-38C		21	18-33		21	18-33																
91	III	24-38C		21	18-33		21	18-33																
92	III	24-38C		21	18-33		21	18-33																
93	III	24-38C		21	18-33		21	18-33																
94	III	24-38C		21	18-33		21	18-33																
95	III	24-38C		21	18-33		21	18-33																
96	III	24-38C		21	18-33		21	18-33																
97	III	24-38C		21	18-33		21	18-33																
98	III	24-38C		21	18-33		21	18-33																
99	III	24-38C		21	18-33		21	18-33																
100	III	24-38C		21	18-33		21	18-33																

Corpuscle Volume (μ³)

Stage of Development	Man			Cat			Cow			Goat			Pig			Rabbit			Rat			Sheep		
	Value	Range	Value	Value	Range	Value	Value	Range	Value	Value	Range	Value	Value	Range	Value	Value	Range	Value	Value	Range	Value	Value	Range	
49	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	
50	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	
51	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	
52	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	
53	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	
54	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	
55	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	
56	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	
57	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	
58	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	
59	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	
60	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	

11/ Values quoted for adult female are not necessarily those of the mother. Additional values for man may be found in the table on Erythrocyte Values in Pregnancy and Postpartum Man. 12/ Gestation period for man in days is 280; cat, 60; goat, 147; pig, 114; rabbit, 31; rat, 21; sheep 137. 13/ Age 3-18 days. 14/ Age 3-18 days. 15/ Probably by caesarian section. 16/ Age 1-10 hrs. 17/ Age 2-18 hrs. 18/ Age 24-48 hrs. 19/ Age 1-7 days. 20/ Age 8-14 days.

47. ERYTHROCYTE OXYGEN CONSUMPTION¹

47. ERYTHROCYTES		Blood (B); Cells (C)		Temperature of Measurement (°C)	Method	
Animal		$\mu\text{l O}_2/\text{mg dry wt/hr.}$				
		In Serum	In Ringer or Saline	(D)	(E)	
(A)		(B)	(C)			
1	Man	B ⁴	-0.0152	37	Chemical	
2		B ⁴	-0.018	37	Manometric	
3		C ⁵	-0.0422	37		
4		C ⁶	-0.062	25	Manometric	
5	Alligator, American	C ⁴	-0.113	-0.0673	38	Chemical
6		B ⁴	-0.35	-0.212	25	Manometric
7	Chicken	B ⁴	-0.26	-0.182	37	Manometric
8		C ⁶	-0.227	-0.0753	20	
9		C ⁶	-0.112	-0.0513	25	Manometric
10	Fish, puffer	C ⁶	-0.111	-0.402	37	Manometric
11	Fish, sea robin	C ⁶	-0.72	-0.442	39	Chemical
12	Fish, toad	B ⁴	-0.67	-0.442	25	Manometric
13	Frog, bull	B ⁴	-0.25	-0.0282	38	
14	Goose	B ⁴	-0.064	-0.0492	37	Chemical
15		B ⁴	-0.062	-0.0492	25	Manometric
16		B ⁴	-0.22	-0.0242	37	
17	Rabbit	B ⁴	-0.154	-0.0813	25	Manometric
18		C ⁷	-0.173	-0.0833	25	
19	Snake, garter	C ⁶	-0.062	-0.062	25	Manometric
20		C ⁶	-0.096	-0.0673	25	
21	Snake, water	C ⁶	-0.158	-0.0813	25	Manometric
22		C ⁶	-0.119	-0.0753	25	
23	Turtle	C ⁶	-0.096	-0.0673	25	Manometric
24	Turtle, Blanding's	C ⁶	-0.158	-0.0813	25	
25	Turtle, box	C ⁶	-0.119	-0.0753	25	
26	Turtle, snapper	C ⁶	-0.096	-0.0673	25	Manometric

These signs are a convention to indicate loss of the quantity of oxygen in contact with the red corpuscles. All values calculated being 70% by weight. /2/ Ringer.

buffy coat removed.

/1/ The minus signs are a convention to indicate loss of the quantity of oxygen from the atmosphere in contact with the red corpuscles. All values calculated on the basis of water content of cells being 70% by weight. /2/ Ringer. /3/ Isotonic saline. /4/ Defibrinated. /5/ Washed, buffy coat removed. /6/ Washed cells of whole blood. /7/ Suspension of R B C.

48. ERYTHROCYTE CARBOHYDRATE METABOLISM

Animal	Substrate ¹	Rate of Lactic Acid Formation ²		Rate of Methemoglobin Reduction ³	Enzymes Probably Involved in Utilization ⁴
		Value	Range		
(A)	(B)	(C)	(D)	(E)	(F)
1	-	-2.6	-6.1 to 0.8b		
2	se	23.8	12.1-39.3b	0.06	
3	se	24.5	1.8-47.2b	0.77	
4	se	19.5	4.7-34.3b	0.79	
5	se	-0.5	-4.0 to 3.0b	0.47	Glycolytic enzymes ⁶
6	se	4.3	-2.8 to 11.4b	0.15	Unknown
7	se	8.9	1.1-16.7b	1.07	Malic dehydrogenase, oxaloacetic acid decarboxylase
8	se	3.8	-0.1 to 7.1b	1.12	Malic dehydrogenase, oxaloacetic acid decarboxylase
9	se	21.0	13.9-28.1b	1.15	Lactic dehydrogenase
10	se	20.5	11.1-29.9b	0.78	
11	se	22.0	14.2-29.6b	0.86	
12	se	1.2	-0.6 to 3.0b	0.69	
13	se	17.4	4.5-30.3b	0.26	Glycolytic enzymes ⁶
14	se	33.8	19.1-48.5b	1.19	Unknown
15	se	3.5	-0.4 to 7.4b	1.20	Malic dehydrogenase, oxaloacetic acid decarboxylase
16	se	48.7	28.3-69.1b	1.27	Malic dehydrogenase, oxaloacetic acid decarboxylase
17	se	59.3	36.4-82.2b	0.46	Lactic dehydrogenase
18	se	56.8	32.7-80.9b	2.92	
19	se	13.5	7.4-19.6b	3.07	Glycolytic enzymes ⁶
20	se	28.3	24.2-32.4b	2.80	
21	se	44.5	29.4-59.6b	1.21	Unknown
22	se			2.08	Malic dehydrogenase, oxaloacetic acid decarboxylase
23	se			1.82	Malic dehydrogenase, oxaloacetic acid decarboxylase
24	se			5.92	Lactic dehydrogenase

¹/RBC is not able to utilize succinate. ²/ CO₂/hour/4ml of a 50% RBC suspension in Krebs-Ringer bicarbonate buffer under anaerobic conditions. ³/ gm of reduced Hb/hour/100ml of a 50% suspension of methemoglobin corpuscles in cat and dog cells but not for the hexoses in rabbit cells and for the metabolic intermediates in cat, dog, and rabbit cells except when expressed as the log of the methemoglobin concentration. ⁴/ Exclusive of methemoglobin reductase and of the pyridine nucleotide coenzymes which are probably utilized in methemoglobin reduction. ⁵/ Free endogenous control. ⁶/ And possibly zwischentferment.

49. BLOOD LEUKOCYTE VALUES, BIRTH TO MATURITY: MAN¹

Age	Leukocytes Total ²		Neutrophils Total ³		Neutrophils Band Forms ³		Neutrophils Segmented Forms ³		Eosinophils		Basophils		Lymphocytes		Monocytes	
	Value	Range ⁵	Value	Range ⁵	Value	Range ⁵	Value	Range ⁵	Value	Range ⁵	Value	Range ⁵	Value	Range ⁵	Value	Range ⁵
	(U)	(L)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)	(P)	(Q)
Thousands/mm ³ -- % of total leukocytes ⁴																
1 At Birth	18.1 100	9.0-30.6	11.0 61	6.0-26.0	1.85 9.1		8.4 52		0.40 2.2	0.02-0.55	0.10 0.6	0-0.64	5.5 31	2.0-11.0	1.05 5.0	0.40-3.17
2 End 12 hours ⁷	22.8 100	15.0-35.0	15.5 69	6.0-32.0	2.32 10.2		13.2 58		0.45 2.0	0.02-0.03	0.10 0.4	0-0.50	5.5 24	2.0-11.0	1.20 5.3	0.40-3.67
3 End 24 hours ⁷	18.9 100	9.4-34.0 ⁸	11.5 61	5.0-21.0	1.75 9.2		9.8 52		0.45 2.4	0.05-1.00	0.10 0.5	0-0.30	5.8 31	2.0-11.5	1.10 5.8	0.30-3.1 ⁹
4 End 1 week ⁷	12.2 100	5.0-22.0	8.5 45	3.5-10.0	0.83 5.0		4.7 59		0.50 4.1	0.07-1.10	0.05 0.4	0-0.25	5.0 41	2.0-17.0	1.10 9.1	0.30-2.7 ⁹
5 End 2 weeks ⁷	11.4 100	5.0-20.0	4.5 40	3.0-9.5	0.63 5.5		3.9 54		0.35 3.1	0.07-1.00	0.05 0.4	0-0.25	5.5 48	2.0-17.0	1.00 8.8	0.20-2.4 ⁹
6 End 4 weeks ⁷	10.8 100	5.0-18.5	3.8 35	3.0-9.0	0.49 6.5		3.5 30		0.30 2.6	0.07-0.30	0.05 0.5	0-0.20	6.0 80	2.5-18.5	0.70 8.5	0.15-2.0 ⁹
7 End 2 months ⁷	11.0 100	5.5-18.0	3.8 34	3.0-9.0	0.49 6.4		3.3 50		0.30 2.7	0.07-0.85	0.05 0.5	0-0.20	5.3 57	3.0-16.0	0.85 5.9	0.15-1.0 ⁹
8 End 4 months ⁷	11.5 100	6.0-17.5	3.8 35	3.0-9.0	0.45 5.9		3.3 29		0.30 2.6	0.07-0.80	0.05 0.4	0-0.20	6.8 59	3.5-14.5	0.80 5.2	0.10-1.5 ⁹
9 End 6 months ⁷	11.9 100	6.0-17.5	3.8 32	3.0-8.5	0.45 5.8		3.2 28		0.30 2.5	0.07-0.75	0.05 0.4	0-0.20	7.5 61	4.0-13.5	0.58 6.8	0.10-1.3 ⁹
10 End 8 months ⁷	12.2 100	6.0-17.5	3.7 30	3.0-8.5	0.41 5.2		3.3 27		0.30 2.5	0.07-0.70	0.05 0.4	0-0.20	7.6 62	4.5-12.5	0.58 4.7	0.00-1.3 ⁹
11 End 10 months ⁷	12.0 100	6.0-17.5	3.6 30	3.0-8.5	0.40 5.2		3.2 27		0.30 2.5	0.08-0.70	0.05 0.4	0-0.20	7.5 62	4.5-11.5	0.55 4.0	0.05-1.2 ⁹
12 End 12 months ⁷	11.6 100	6.0-17.5	3.5 31	3.5-8.5	0.35 5.1		3.2 28		0.30 2.6	0.05-0.70	0.05 0.4	0-0.20	7.0 61	4.0-10.5	0.55 4.8	0.05-1.1 ⁹

1. The data are from smoothed curves plotted from averages of means from the literature. Apparent discrepancies in addition are due to rounding off after calculations were made. 2. Values in B are sums of values in D, J, L, N, P. 3. Includes a small percentage of myelocytes during first several days after birth. 4. The upper of the two numbers for each age represents thousands per mm³, the lower, the percentage of cells of the given type relative to the total leukocyte count. 5. Ranges are from smoothed curves plotted from average of ranges from the literature. Range values are estimates of the 95% range, and may be regarded as conforming to type "d", i.e., common experience. 6. Note that the range of counts and the range of percentages for any given cell type and age are not mathematically related. 6f. Approximately 3 nucleated red cells per 100 leukocytes have been found at birth. 7. Values and ranges within the first year are from fragmentary data. 7a. An extreme range of 3,500-45,000 has been observed.

49. BLOOD LEUKOCYTE VALUES, BIRTH TO MATURITY: MAN (Concluded)

Age	Leukocytes Total ²		Neutrophils Total		Neutrophils Band Forms ³		Neutrophils Segmented Forms ⁴		Eosinophils		Basophils		Lymphocytes		Monocytes	
	Value		Value		Value		Value		Value		Value		Value		Value	
	Range ⁵	Value	Range ⁵	Value	Range ⁵	Value	Range ⁵	Value	Range ⁵	Value	Range ⁵	Value	Range ⁵	Value	Range ⁵	Value
Thousands/mm ³ —% of total leucocytes ⁴																
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)	(P)	(Q)
25 End 2 years	10.6	6.0-17.0	3.9	1.5-8.5	0.32	3.2	3.2	0.28	0.04-0.65	0.05	0.0-0.20	0.05	6.3	2.0-9.5	0.55	0.05-1.07
26	100		33		3.0	30		2.0		0.5			59		5.0	
27 End 4 years	9.1	5.5-15.5	3.8	1.5-8.5	0.27	3.5	1.5-7.5	0.25	0.02-0.65	0.05	0.0-0.20	0.05	4.5	2.0-8.0	0.45	0.0-0.8
28	100		42		3.0	39	16-60	2.8		0.6			50		5.0	
29 End 6 years	8.5	5.0-14.5	4.3	1.5-8.0	0.25	4.0	1.5-7.0	0.23	0.0-0.65	0.05	0.0-0.20	0.05	3.5	1.5-7.0	0.40	0.0-0.8
30	100		51		3.0	48	16-60	2.7		0.6			42		4.7	
31 End 8 years	8.3	4.5-13.5	4.4	1.5-8.0	0.25	4.1	1.5-7.0	0.20	0.0-0.60	0.05	0.0-0.20	0.05	3.3	1.5-8.8	0.35	0.0-0.8
32	100		53		3.0	50	18-60	2.4		0.6			39		4.2	
33 End 10 years	8.1	4.5-13.5	4.4	1.8-8.0	0.24	4.2	1.8-7.0	0.20	0.0-0.60	0.04	0.0-0.20	0.04	3.1	1.5-8.5	0.35	0.0-0.8
34	100		54		3.0	51	18-60	2.4		0.5			36		4.3	
35 End 12 years	8.0	4.5-13.5	4.4	1.8-8.0	0.24	4.2	1.8-7.0	0.20	0.0-0.55	0.04	0.0-0.20	0.04	3.0	1.2-6.0	0.35	0.0-0.8
36	100		55		3.0	52	16-60	2.3		0.5			38		4.4	
37 End 14 years	7.9	4.5-13.0	4.4	1.8-8.0	0.24	4.2	1.8-7.0	0.20	0.0-0.50	0.04	0.0-0.20	0.04	2.9	1.2-5.8	0.38	0.0-0.8
38	100		56		3.0	53	18-60	2.5		0.5			37		4.7	
39 End 16 years	7.8	4.5-13.0	4.4	1.8-8.0	0.23	4.2	2.5-7.0	0.20	0.0-0.50	0.04	0.0-0.20	0.04	2.8	1.2-5.2	0.40	0.0-0.8
40	100		57		3.0	54		2.6		0.5			35		5.1	
41 End 18 years	7.7	4.5-12.5	4.4	1.8-7.7	0.23	4.2	2.5-7.0	0.20	0.0-0.45	0.04	0.0-0.20	0.04	2.7	1.0-5.0	0.40	0.0-0.8
42	100		57		3.0	54		2.6		0.5			35		5.2	
43 End 20 years	7.5	4.5-11.5	4.4	1.8-7.7	0.23	4.2	1.8-7.0	0.20	0.0-0.45	0.04	0.0-0.20	0.04	2.5	1.0-4.8	0.38	0.0-0.8
44	100		59		3.0	58	37-75	2.7		0.5			33		5.0	
45 End 21 years	7.4	4.5-11.0	4.4	1.8-7.7	0.22	4.2	1.8-7.0	0.20	0.0-0.45	0.04	0.0-0.20	0.04	2.5	1.0-4.8	0.30	0.0-0.8
46	100		59		3.0	56	37-75	2.7		0.5			34		4.0	

50. BLOOD LEUKOCYTE VALUES AT ALTITUDE: MAN

Cell Type	At Sea Level ¹		At Altitude of 3,730 Meters ²		At Altitude of 4,500 Meters ³	
	Value	Range	Value	Range	Value	Range
	(B)	(C)	(D)	(E)	(F)	(G)
(A)						
1 Leukocytes, total, (per mm ³ b1)	6,800	3,480-14,840	6,500	3,400-9,600	6,900	4,700-10,900
2 Leukocytes, Segmented, %	55.1	38-70	52.8	32-79	49.9	25-71
3 Neutrophils, Band, %	2.6	0-6	5.0	0-3	3.0	0-5
4 Eosinophils, %	4.2	0-15	2.5	0-10	2.2	0-2
5 Basophils, %	0.6	0-2	0.1	11-54	39.4	21-62
6 Lymphocytes, %	29.8	18-49	34.8	0-9	5.5	1-13
7 Monocytes, %	7.2	2-14.5	4.9			

¹/ Lima, Peru. ²/ Oroya, Peru. ³/ Morococha, Peru.

¹/ Lima, Peru. ²/ Oroya, Peru. ³/ Morococha, Peru.

51. BLOOD LEUKOCYTE VALUES IN PREGNANCY AND POSTPARTUM: MAN

Cell Type	2nd-3rd month		4th-5th month		6th-7th month		8th-9th month		5th-9th week postpartum	
	Value	Range	Value	Range	Value	Range	Value	Range	Value	Range
	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)
1 Leukocytes, total	10,100	5,000-15,000	10,600	5,500-15,500	10,600	5,500-15,500	10,400	5,500-15,500	8,200	4,500-11,900
2 Leukocytes, range	62.5	2.0	67.0	2.0	69.5	1.5	69.0	1.5	51.5	3.0
3 Neutrophils, %	2.0	0.2	2.0	0.2	1.5	0.2	1.5	0.2	0.3	0.3
4 Eosinophils, %	0.2	31.0	27.0	4.0	0.2	25.0	0.2	25.5	41.0	4.0
5 Basophils, %	31.0	4.5	4.0		4.0		4.0			
6 Lymphocytes, %										
7 Monocytes, %										

¹/ Venous blood. For values in non-pregnant woman, see Table 49.

52. BLOOD LEUKOCYTE VALUES¹: CERTAIN LABORATORY ANIMALS

Cell Types	Count per mm ³			% of Total			Count per mm ³			% of Total		
	Value (B)	Range (C)	Value (D)	Range (E)	Value (F)	Range (G)	Value (H)	Range (I)				
(A)	Cat						Rat					
1 Total Leukocytes	16,000	9,000-24,000 ^c	(100%)		44-82 ^c		14,000	5,000-25,000 ^c	(100%)		9-34 ^c	
2 Neutrophils	9,500	5,500-16,500 ^c	59.5%		2-11 ^c		3,100	1,100-6,000 ^c	22%		0-6 ^c	
3 Eosinophils	850	200-2,500 ^c	5.4		0-0.5 ^c		300	0-700 ^c	2.2		0-1.5 ^c	
4 Basophils	20	0-100 ^c	0.1		15-44 ^c		100	0-200 ^c	0.5		65-84 ^c	
5 Lymphocytes	5,000	2,000-9,000 ^c	31		0.5-7 ^c		10,200	7,000-16,000 ^c	73		0-5 ^c	
6 Monocytes	650	50-1,400 ^c	4				300	0-650 ^c	2.3			
	Dog						Mouse					
7 Total Leukocytes	12,000	8,000-18,000 ^c	(100%)		62-80 ^c		8,000	4,000-12,000 ^c	(100%)		12-44 ^c	
8 Neutrophils	8,200	6,000-12,500 ^c	68%		2-14 ^c		2,000	700-4,000 ^c	25.5%		0-5 ^c	
9 Eosinophils	600	200-2,000 ^c	5.1		0-2 ^c		150	0-500 ^c	2		0-1 ^c	
10 Basophils	85	0-300 ^c	0.7		10-28 ^c		50	0-100 ^c	0.5		54-85 ^c	
11 Lymphocytes	2,500	900-4,500 ^c	21		3-9 ^c		5,500	3,000-8,500 ^c	68		0-15 ^c	
12 Monocytes	650	300-1,500 ^c	5.2				300	0-1,300 ^c	4			
	Rabbit						Guinea Pig					
13 Total Leukocytes	9,000	6,000-13,000 ^c	(100%)		36-52 ^c		10,000	7,000-19,000 ^c	(100%)		22-50 ^c	
14 Neutrophils ²	4,100	2,500-6,000 ^c	46%		0.5-3.5 ^c		4,200	2,000-7,000 ^c	42%		2-12 ^c	
15 Eosinophils	180	0-400 ^c	2		2-7 ^c		400	200-1,300 ^c	4		0-2 ^c	
16 Basophils	450	150-750 ^c	5		30-52 ^c		70	0-300 ^c	0.7		37-64 ^c	
17 Lymphocytes	3,500	2,000-5,600 ^c	39		4-12 ^c		4,900	3,000-9,000 ^c	49		3-13 ^c	
18 Monocytes	725	300-1,300 ^c	8				430	250-2,000 ^c	4.3			

¹/ Values and ranges in this table are approximate averages of highly variable unweighted means and ranges from the literature. ²/ In rabbits and guinea pigs, cells classed as "neutrophils" include "pseudo-eosinophils," "amphophils," or "heterophils."

MAN

50. BLOOD LEUKOCYTE VALUES AT ALTITUDE:		At Altitude of 4,500 Meters ³	Range
		At Altitude of 3,730 Meters ²	

Cell Type	At Sea Level ¹		At Altitude of 3,730 Meters		Value (F)	Range (G)
	(C)		(E)			
	Value (B)	Range	Value (D)	Range		
(A)						
1 Leukocytes, total, (per mm ³ bl)	6,800	3,480-14,840	6,500	3,400-9,600	6,900	4,700-10,900
2 Neutrophils, Segmented, %	55.1	38-70	52.8	32-79	49.9	25-71
3 Neutrophils, Band, %	4.2	0-6	5.0	0-10	3.0	0-5
4 Eosinophils, %	4.2	0-15	2.5	0-3	2.2	0-2
5 Basophils, %	0.6	0-2	0.1	11-54	39.4	21-62
6 Lymphocytes, %	29.8	18-49	34.8	0-9	5.5	1-13
7 Monocytes, %	7.2	2-14.5	4.9			

(A) Morococha, Peru.

Monocytes, %	Lima, Peru	Oroya, Peru	Morococha, Peru
7			

POSTPARTUM: MAN

51. BLOOD LEUKOCYTE VALUES IN PREGNANCY AND POSTPARTUM.						
Cell Type	2nd-3rd month	4th-5th month	6th-7th month	8th-9th month	5th-9th week postpartum	
	(B)	(C)	(D)	(E)	(F)	
(A)	10, 100	10, 600	10, 600	10, 400	8, 200	
1 Leukocytes, total	5, 000-15, 000	5, 500-15, 500	5, 500-15, 500	5, 500-15, 500	4, 500-11, 900	
2 Leukocytes, range	62.5	67.0	69.5	69.0	51.5	
3 Neutrophils, %	2.0	2.0	1.5	1.5	3.0	
4 Eosinophils, %	0.2	0.2	0.2	0.2	0.3	
5 Basophils, %	31.0	27.0	25.0	25.5	41.0	
6 Lymphocytes, %	4.5	4.0	4.0	4.0	4.0	
7 Monocytes, %						

Monocytes. %	
11/	Venous blood. For values in non-pregnant woman, see Table 49.

52. BLOOD LEUKOCYTE VALUES¹: CERTAIN LABORATORY ANIMALS

Cell Types	Count per mm ³			% of Total			Count per mm ³			% of Total		
	Value (B)	Range (C)	Value (D)	Range (E)	Value (F)	Range (G)	Value (H)	Range (I)				
(A)	Cat						Rat					
1 Total Leukocytes	16,000	9,000-24,000 ^c	(100%)		14,000	5,000-25,000 ^c	(100%)		9-34% ^c			
2 Neutrophils	9,500	5,500-16,500 ^c	59.5%	44-82% ^c	3,100	1,100-6,000 ^c	22%		0-6 ^c			
3 Eosinophils	850	200-2,500 ^c	5.4	2-11 ^c	300	0-700 ^c	2.2		0-1.5 ^c			
4 Basophils	20	0-100 ^c	0.1	0-0.5 ^c	100	0-200 ^c	0.5		65-84 ^c			
5 Lymphocytes	5,000	2,000-9,000 ^c	31	15-44 ^c	10,200	7,000-16,000 ^c	73		0-5 ^c			
6 Monocytes	650	50-1,400 ^c	4	0.5-7 ^c	300	0-650 ^c	2.3					
	Dog						Mouse					
7 Total Leukocytes	12,000	8,000-18,000 ^c	(100%)		8,000	4,000-12,000 ^c	(100%)		12-44% ^c			
8 Neutrophils	8,200	6,000-12,500 ^c	68%	62-80% ^c	2,000	700-4,000 ^c	25.5%		0-5 ^c			
9 Eosinophils	600	200-2,000 ^c	5.1	2-14 ^c	150	0-500 ^c	0.5		0-1 ^c			
10 Basophils	85	0-300 ^c	0.7	0-2 ^c	50	0-100 ^c	0.5		54-85 ^c			
11 Lymphocytes	2,500	900-4,500 ^c	21	10-28 ^c	5,500	3,000-8,500 ^c	68		0-15 ^c			
12 Monocytes	650	300-1,500 ^c	5.2	3-9 ^c	300	0-1,300 ^c	4					
	Rabbit						Guinea Pig					
13 Total Leukocytes	9,000	6,000-13,000 ^c	(100%)		10,000	7,000-19,000 ^c	(100%)		23-50% ^c			
14 Neutrophils ²	4,100	2,500-6,000 ^c	46%	36-52% ^c	4,200	2,000-7,000 ^c	42%		2-12 ^c			
15 Eosinophils	180	0-400 ^c	2	0.5-3.5 ^c	400	200-1,300 ^c	4		0-2 ^c			
16 Basophils	450	150-750 ^c	5	2-7 ^c	70	0-300 ^c	0.7		37-64 ^c			
17 Lymphocytes	3,500	2,000-5,600 ^c	39	30-52 ^c	4,900	3,000-9,000 ^c	49		3-13 ^c			
18 Monocytes	725	300-1,300 ^c	8	4-12 ^c	430	250-2,000 ^c	4.3					

/1/ Values and ranges in this table are approximate averages of highly variable unweighted means and ranges from the literature. /2/ In rabbits and guinea pigs, cells classed as "neutrophils" include "pseudo-eosinophils," "amphophils," or "heterophils."

53. BLOOD LEUKOCYTE RANGES: FARM ANIMALS

53. BLOOD LEUKOCYTE RANGES: FARM ANIMALS							
Animal	Leukocytes Thousands/mm ³ blood	Number/mm ³ blood					Monocytes
		Neutrophils	Eosinophils	Basophils	Lymphocytes	(G)	
(A)	(B)	(C)	(D)	(E)	(F)	(G)	
1 Cattle	5-12 ^d	1,200-4,800 ^d	180-1,800 ^d	0-100 ^d	2,700-6,900 ^d	150-1,800 ^d	
2 Goat	5-14 ^d	2,100-3,350 ^d	0-1,100 ^d	0-600 ^d	2,100-11,250 ^d	50-600 ^d	
3 Horse	5-11 ^d	3,000-6,900 ^d	50-600 ^d	0-100 ^d	1,200-4,800 ^d	100-1,450 ^d	
4 Sheep	4-10 ^d	1,000-4,500 ^d	50-700 ^d	0-200 ^d	2,500-7,000 ^d	50-800 ^d	
5 Swine	7-20 ^d	2,400-10,000 ^d	50-2,000 ^d	0-800 ^d	3,200-12,000 ^d	50-2,000 ^d	
6 Chicken	16-40 ^d	4,000-16,000 ^d	400-4,000 ^d	200-1,600 ^d	8,000-24,000 ^d	1,000-6,000 ^d	

54. MORPHOLOGY OF BLOOD LEUKOCYTES AND PLATELETS: MAN¹

CYTOPLASM					NUCLEUS					Parachromatin Pattern and Amount
Cell Type	Size μ	Granules	Relative Amount	Color	Shape (F)	Position (G)	Nu- clear Mem- brane (H)	Nu- cleoli (I)	Chromatin Pattern (J)	
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)
1 Band cell, Neutrophilic ² (Regenerative)	10-15	Full complement of spe- cific granules, pink to rose-violet			Rod-like, or deeply indented no segmentation				Thickened chromatin strands form coarse chromatin masses with a few distinct interstices	Small amount; pale blue or pink, seen as distinct clumps between chromatin masses.
2 Granulocytes, segmented ²		Full complement of spe- cific granules ³			Polymor- phous, often indented, constrict- ed					
3 (a) Neutrophilic	9-15	Specific granules are small, fine pink to rose- violet and irregularly distributed throughout cytoplasm	Abundant	Colorless or slightly acidophilic	(a) 2 or more lobes, normal maximum = 5.	Central or ec- centric.	Thick, heavy	None visible	(a)(b) Thickened chro- matin strands form coarse chromatin masses with a few distinct interstices.	(a)(b) Small amount; small irregular, but distinct clumps be- tween chromatin masses.
4 (b) Eosinophilic		Specific granules are red and throughout cyto- plasm			(b) 2 to 4 lobes				(c) Chromatin pattern less distinct than (a) (b); amudges.	(c) Much less distinct than in (a)(b)
5 (c) Basophilic		Specific granules are metachromatic, water soluble, vary in size, and may obscure the nu- cleus; are irregularly distributed.			(c) Slightly in- dented or irregu- lar; less lobula- tion than (a)(b)					

54. MORPHOLOGY OF BLOOD LEUKOCYTES AND PLATELETS: MAN (Concluded)

CYTOPLASM

NUCLEUS

Parachromatin Pattern and Amount

Cell Type	Size μ	Granules	Relative Amount	Color	Shape	Position	Nuclear Membrane	Nucleoli	Chromatin Pattern	Parachromatin Pattern and Amount
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)
Lymphocyte ²	6-8	May or may not contain round, red, relatively large, but sparse azurophilic granules; about 10-50% of lymphocytes present them	Usually form narrow band	Varying shades of pale to dark blue.	Round, oval, or reniform, slightly or deeply indented	Usually centrally or eccentric.	Thick, heavy.	None visible	Large coarse dark purple chromatin blocks blend imperceptibly with colorless or pale blue parachromatin-parachromatin distinction.	Small amount in small lymphocytes pale-blue or colorless. Moderate amount in medium lymphocytes pale-blue or colorless but appreciably paler than small lymphocytes. No sharp distinction from chromatin.
Small	6-8		Narrow band, or moderate amount							
Medium	9-14	Contain very fine, irregularly distributed azurophilic granules such are so small that they are called "asterophil dust," are sometimes coarser	Abundant	Muddy blue or gray blue, occasionally vacuolated.	Usually reniform or horse-shoe shaped, or polylobular.	Usually eccentric.	Usually acety thick		Network of slender abundant thin threads, thickenings at their junctions and forming definite but irregular interstices	Parachromatin more abundant than in lymphocytes and distinct from chromatin.
Monocyte ² 4 (Transitional or blood mononuclear)	14-20	Central group of azurophilic granules comprise chromatin, spread throughout mass if fixed rapidly ⁵	Believed to consist only of a fragment of megakaryocyte cell body.	Light blue hyaline.	No nucleus.					
Thrombocyte ² (Platelet)	1-5									

1/1. Table applies only to elements as observed in ordinary air-dried smears after Romanowsky stains. For characteristics of the corresponding elements as observed in tissue sections and mount smears, refer to Chapter 5. Maximow, A. A. & Bloom, W. "A Textbook of Histology" W. B. Saunders, Philadelphia, 1948. For characteristics of the corresponding elements as observed with the supravital technique, refer to Tompkins, E. H. & Cunningham, R. S., in Section IX and X in the "Handbook of Hematology," 2nd ed., Editor Paul H. Horder, Blood 4 (8), 1949. 2/2. Nomenclature recommended by 1945 - 1952 International Conference on Nomenclature of Blood and Blood-forming Organs (Blood 4 (8), 1949). 3/3. Granular in any stage of development, specific granules of all 750-1500 in diameter. Basophilic - from as small as neutrophils and monocytes. 4/4. Both cytoplasm and nucleus are usually more lymphocytic in non-human species 5/5. 80-100 azurophilic granules are seen under electron microscope.

55. PROPERTIES AND FUNCTIONS OF WHITE BLOOD CELLS AND RELATED FORMS				
Cell Type (A)	Physical and Chemical Properties (B)	Chemical Contents and Stain Reactions		
		Nucleus and Cytoplasm (C)	Nucleus (D)	Cytoplasm (E)
		Chemical Contents		Biological Properties and Functions (F)
1	Physical Properties: Cell Specific gravity = 1.066. Migrate towards anode. Cathoretic velocity slower than lymphocytes.	Acid phosphatase; Alkaline phosphatase; Amylase. Catalase; Cytochrome oxidase. Fluorolysin Histamine Lipase; Nucleolase Phosphorylase Proteases Adenosinase Cathexins Lysosyme; Nuclease. Peptidase. Trypsin Trypsinase (trypsin); Trypanase. Verdoperoxidase.	Sulfur ¹ .	Phagocytosis; amoeboid locomotion (28-34, per minute). Show diapedesis and adhere to endothelium under stimulation. May show marked cytoplasmic budding. Exhibit chemotaxis positive and negative for about 1 mm distance. Retain integrity best in isotonic, slightly hypertonic, or slightly hypotonic solution. Fracture inversely proportional to asphragmocyte for bacteria, quite common for blood, tissue cells, debris, antigen-antibody compounds, and foreign bodies. Phagocytic ability proportional to asphragmocyte acid content. Phagocytosis enhanced by opsoning and bacteriotropins. Phagocytosis enhanced by coagulase. Migrate into areas of inflammation, especially acute. Elaborate soluble, antigenically active material from particulate antigens. Associated with complement formation. Associated with complement formation. Produce agglutins. Are agglutinated by coagulase. Are source for oxidase effusion. Are source for verdoperoxidase. High oxygen consumption. High glycolytic activity. Digest fibrin. Post mitotic. Extravascular maturation. Life span in blood 0.5 to 3 days. Disintegrate to "pus corpuscles". Disappear quickly in tissue culture exponents.
5	Polarized, but may reverse direction. Are sensitive to irradiation; particularly in hemopoietic tissue Constriction rings due to external factors ¹ .			
10	Physical Properties: Cell Granules Slightly refractile. Little or no electron-scattering hull Active during movement of cell.			
20	Chemical Properties Are very sensitive to moderate pH changes from normality. Are very sensitive to benzene and related compounds; sensitivity may be property of regenerative not of adult forms Adult forms more resistant to IHN, than regenerative forms. Respond to leukotoxins. Exhibit chemotaxis. Exhibit oxidase effusion. High glycolytic activity. Reduce potassium tellurite.	Sudan black B positive Acridine orange positive.	Feulgen positive.	Granules: Acid fast. Nile blue sulphate positive. Sudan III positive. Stain red-lilac with Wright's stain. Stain violet with Ehrlich's "tri-acid" stain. Sudan black B positive. Acid hematein positive. Neutral red positive. Non-specific tartraphil granules.
25				
30				
35				
40				

(1) Statement of a positive finding in this table does not necessarily imply a negative finding in the same respect elsewhere in the table. (2) Questioned.
(3) Inhibited by leukotoxins; decreased by alcohol. Positive chemotaxis of leukocytes, cellulose, starch, glycogen, glucose, maltose, levulose, fructose, absorbent cotton. No chemotaxis: olive oil, various inorganic salts, oleic acid, Na₂ K₂ Mg, and Ca palmitate, stearic acid, carbon, quartz, glass, washed MnO₂, non-absorbent cotton, raw cotton. Negative chemotaxis: aluminum oxide. (4) Less than lymphocytes. (5) Contain major portion of alkaline phosphatases of white cell suspensions. (6) Trace. (7) May be a common esterase. (8) Present in significant amounts only in rabbit neutrophils. (9) In cells; in man found in exudates rich in neutrophilic segmented cells. (10) Nucleus contains 1.8% sulfur. (11) Amount decreases with maturation. (12) Extractable with acetone.

55. PROPERTIES AND FUNCTIONS OF WHITE BLOOD CELLS AND RELATED FORMS (Continued)					
Cell Type (A)	Physical and Chemical Properties (B)	Chemical Contents and Stain Reactions			Biological Properties and Functions (F)
		Nucleus and Cytoplasm (C)	Nucleus (D)	Cytoplasm (E)	
Tissue Eosinophil ¹⁰⁹		Chemical Contents			
		No acid phosphatase.		Cytoplasm proper: No ribonucleoprotein. No glycogen. Granules: Alkaline phosphatase. No glycogen.	
			Stain Reactions		
			Feulgen positive	Cytoplasm proper: HIO-Schiff (PAS) positive Sudan III positive Granules: HIO-Schiff (PAS) positive. Sudanophilic Stain green with thionine.	
Leukocyte, Basophilic (granulocyte, segmented).	Physical Properties		Chemical Contents		Possess amoeboid locomotion (slower than neutrophils or eosinophils). Migrate into areas of inflammation. Phagocytic. May produce heparin. Post mitotic. Extravascular maturation.
	More resistant to irradiation than other granulocytes.			Granules: Oxidase. Glycogen. Peroxidase. Lipid Phospholipids.	
	Chemical Properties				
	Granular metachromatic material is soluble in aqueous solutions Positive chemotaxis to egg albumin	Sudan III positive Sudan black B positive Acridine orange positive.	Stain Reactions	Granules: Show metachromasia. HIO-Schiff (PAS) positive Acid hematein ¹¹⁰ .	
100					
105					
110					

¹¹⁰Statement of a positive finding in this table does not necessarily imply a negative finding in the same respect elsewhere in the table. ¹¹¹Questioned.
¹¹⁶ May be identical with blood eosinophil ¹¹⁷ Variable. ¹¹⁹ Selective and rare.

55. PROPERTIES AND FUNCTIONS OF WHITE BLOOD CELLS AND RELATED FORMS! (Continued)

Cell Type (A)	Chemical Contents and Stain Reactions			Biological Properties and Functions (F)
	Physical and Chemical Properties (B)	Nucleus and Cytoplasm (C)	Nucleus (D)	
45	Physical Properties Core of granules offers little resistance to electric currents	Amylase, Cytochrome oxidase, Hyaluridase, Lipase, Papainase Trypsinase, Verdoperoxidase.	Chemical Contents Alkaline phosphatase.	Possess amoeboid locomotion, but are usually slower than neutrophils (5-8 μ per minute). Occasionally travel very rapidly in supravital preparations. Migrate into areas of inflammation. Phagocytic (usually less than neutrophils). Transport anaphylactogenic substances (antigen). Source of blood histamine. Cells are slowly affected by anisotonia ("hardy" cells). Extravascular maturation. Survive 10 days or more in vitro.
50	Chemical Properties Form Charcot-Leyden crystals. Nucleus selectively dissolved with wetting agents			
55				
60				
65				
70		Acridine orange positive	Stain Reactions Feulgen positive.	
75				

1/Statement of a positive finding in this table does not necessarily imply a negative finding in the same respect elsewhere in the table. 12/Questioned. 13/Probably nuclear in origin. Crystals are basophilic and pyramidal with bases opposed. 14/Rate depends upon site and surface. 15/Essentially inflammation due to parasites, repeated foreign protein allergy, epidermal destruction, and tumors; also subacute and chronic inflammations.

55 PROPERTIES AND FUNCTIONS OF WHITE BLOOD CELLS AND RELATED FORMS* (Continued)

Cell Type (A)	Physical and Chemical Properties (B)	Chemical Contents and Stain Reactions			Biological Properties and Functions (F)
		Nucleus and Cytoplasm (C)	Nucleus (D)	Cytoplasm (E)	
		Chemical Contents			
100		No acid phosphatase.		Cytoplasm proper: No ribonucleoprotein No glycogen Granules: Alkaline phosphatase ¹ . No glycogen	
85	Tissue Eosinophil ¹⁶		Stain Reactions Feulgen positive.	Cytoplasm proper: HIO-Schiff (PAS) positive Sudan III positive Granules HIO-Schiff (PAS) positive. Sudanophilic Stain green with thionine	
90					
95					
100		Physical Properties More resistant to irradiation than other granulocytes		Chemical Contents Granules: Oxidase Glycogen ¹ Proteoidase ¹ . Lipid Phospholipids	Possess amoeboid locomotion (slower than neutrophils or eosinophils). Migrate into areas of inflammation Phagocytic ¹ . May produce heparin. Post mitotic Extravascular maturation.
105	Leukocyte, Basophilic (granulocyte, segmented).	Chemical Properties Granular metachromatic material is soluble in aqueous solutions Positive chemotaxis to egg albumin		Stain Reactions Sudan III positive. Sudan black B positive ¹ Acridine orange positive	Granules: Show metachromasia. HIO-Schiff (PAS) positive Acid hematein ¹ .
110					

/1/Statement of a positive finding in this table does not necessarily imply a negative finding in the same respect elsewhere in the table. /2/Questioned /16/ May be identical with blood eosinophil /17/ Variable /18/ Selective and rare

55. PROPERTIES AND FUNCTIONS OF WHITE BLOOD CELLS AND RELATED FORMS (Continued)

Cell Type	Physical and Chemical Properties (B)	Chemical Contents and Stain Reactions			Biological Properties and Functions (F)
		Nucleus and Cytoplasm (C)	Nucleus (D)	Cytoplasm (E)	
(A)			Chemical Contents		
115	Granules more soluble in water than blood basophil granules. Resistant to ribonuclease digestion. Exhibit chemotaxis, especially to egg albumin.		No acid or alkaline phosphatase.	Cytoplasm proper: Hepatrin. Cytoplasm and granules: Hepatrin. No lipase. No veridoperoxidase. No free iron. No glycogen. No nucleic acid. Granules: Acid mucopolysaccharide. Acid phosphatase. Alkaline phosphatase. Cytochrome oxidase. Hepatrin. Monosulfuric acid mucopolysaccharide. Granules chemically not related to mucin or pigment cell granules. Golgi area: Acid phosphatase.	Phagocytosis: very limited. Do not store dye particles. Exhibit chemotaxis. Can shed granules. Associated with hepatic metabolism. Release heparin. May arise heteroplastically from lymphocytes, plasma cells, clasmacytes, histiocytes through endogenous elaboration of mast granules. Mitotic figures are rarely seen.
120					
125					
130	Tissue Mast Cell				
135					
140			Stain Reactions		
145			Feulgen positive.	Cytoplasm: Show metachromasia with toluidin blue. Granules: Show metachromasia with toluidine, toluidin blue, and methylene blue. Are sudanophilic. Stain with pyronin. Methylene blue positive	
150					

/1/Statement of a positive finding in this table does not necessarily imply a negative finding in the same respect elsewhere in the table. /2/Questioned. /19/Less soluble in rat and mouse than in man. /20/Changes to di-, tri-, and tetra- in plasma. /21/Metachromasia resistant to hyaluronidase digestion. /22/May be by granular solution and vacuolation.

55. PROPERTIES AND FUNCTIONS OF WHITE BLOOD CELLS AND RELATED FORMS: (Continued)

56. PROPERTIES AND FUNCTIONS OF WHITE BLOOD CELLS AND RELATED FORMS					
Cell Type	Chemical Contents and Stain Reactions			Biological Properties and Functions (F)	
	Physical and Chemical Properties (B)	Nucleus and Cytoplasm (C)	Nucleus (D)		Cytoplasm (E)
(A)	Physical Properties	Chemical Contents	Nucleus	Cytoplasm	
155	Cataphoretic velocity slightly higher than that of neutrophils and thrombocytes	Adenonase. Acid phosphatase ² . Alkaline phosphatase. Amylase. Cathepsin. No cytochrome oxidase (neg in blood). Esterase (low) Gamma globulin ³ . Lipase ⁴ . Lysozyme Nucleinase. Purine-nucleosidase.	Chromatin comp. Nucleo-histone. Desoxy-ribose-nucleic acid.	Cytoplasm proper: Ribonucleoproteins (basophilic). Acid hematein negative Verdoperoxidase (neg. in blood; may be pos in field of inflammation).	Possess polarized ameboid rotary locomotion (15 to 30% per minute), and tissue cells ⁵ . Phagocytic for bacteria, yeast, blood, and tissue cells ⁶ . Migrate into areas of inflammation. Migrate into areas of I tract. May show marked cytoplasmic budding ⁷ . Cytoplasmic budding may be concurrent with rise in antibody titre ⁸ . Cells are relatively resistant in hypotonic solutions. Oxygen consumption less than that of granulocytes ⁹ . Synthesize protein (globulin) ¹⁰ . Participate in antibody formation ¹¹ . Trophocytic. Transform into monocytes ¹² , into plasma cells. Transform into histiocytes (macrophages) in inflammation and into macrophages, epithelioid cells, giant cells in tissue culture ¹³ . Form granulocyte ¹⁴ . Chromosome size varies with tissue and with age. Develop nuclear vacuoles during degeneration. Collagen deposition may be associated with lymphocyte disintegration. Sensitive to or killed by adrenal cortical extract, HN, or x-rays in vitro. Survive well at pH 6.0-8.0 in vitro. Intermittent. Life span in blood possibly less than 24 hours; in tissues, days or weeks.
160	Very sensitive to irradiation and HN, particularly in hemopoietic tissues ¹ .				
165	Chemical Properties				
170 Lymphocyte.	Are less sensitive than granulocytes to benzene and related compounds Synthesize protein (globulin) ¹ Aerobic glycolysis: slight or none Glycolytic activity half or less than that of granulocytes Do not exhibit chemotaxis ²		Stain Reactions		
175			Lack stainable lipoid ³ Feulgen positive. Substances in blood stain with acridine orange.	Cytoplasm proper: Siderophilic. Granules: Basophilic. Azurophilic granules Granules negative HIO-Schiff (PAS) reaction. Cycentrum ⁴ . Occasional rosette of neutral red vacuoles near cycentrum.	
180					
185					
190					

1/Statement of a positive finding in this table does not necessarily imply a negative finding in the same respect elsewhere in the table. 2/Questioned. 3/More sensitive in nodule than in the rest of the node. 4/Evidence of protein synthesis for "export" disputed. 5/Contain major portion of acid phosphatase in leukocyte suspensions. 6/26/Small amounts: 1/100 that of neutrophils. 7/Highly soluble in alcohol. 8/28/May be first step in disintegration. 9/29/May be due to permeation and segregation into vacuoles instead of phagocytosis. 30/Directly or by supplying essential basic building blocks and by stimulating phosphorylation.

55. PROPERTIES AND FUNCTIONS OF WHITE BLOOD CELLS AND RELATED FORMS: (Continued)

Cell Type (A)	Physical and Chemical Properties (B)	Chemical Contents and Stain Reactions			Biological Properties and Functions (F)
		Nucleus and Cytoplasm (C)	Nucleus (D)	Cytoplasm (E)	
195 Leukocytoid Lymphocyte (of infectious mononucleosis)		No peroxidase. No glycogen ¹ .	Chemical Contents		Possess depolarized locomotion ¹ . Phagocytic for bacteria ¹ .
			Stain Reactions		
			Feulgen positive.	Cytoplasm proper: Methylene blue positive. Cytocentrum: Rosette of neutral red vacuoles about cytocentrum.	
200					
205	Exhibit chemotaxis for about 25 μ distance. Often oxidase positive.	No alkaline phosphatase ¹ . Carbohydrases. Lipase. Nucleinase. Proteolytic enzymes. Verdoperoxidase.	Chemical Contents	Cytoplasm: Glycogen ¹ . Granules: Lipids. Phospholipids.	Locomotion is depolarized Phagocytic for bacteria, cellular debris, pigment, and parasites. Phagocytic for viral dyes ¹ . Exhibit pinocytosis. May show cytoplasmic budding ¹ . Migrate into areas of inflammation. Participate in antibody formation ¹ . Transform into macrophages, epithelioid cells, giant cells, and possibly into fibroblasts. Extravascular maturation.
210					
215	Monocyte (Blood mononuclears).	Acridine orange positive.	Stain Reactions	Cytoplasm: Droplets stain with sudan III ¹ . Acid hematein positive. Droplets stain with Nile blue sulfate Cytocentrum: Rosette of neutral red vacuoles ¹ . Granules: Sudan III positive. Sudan black B positive.	
220					
225					
230					

¹/Statement III a positive finding in this table does not necessarily imply a negative finding in the same respect elsewhere in the table. /2/Questioned. /39/May be due to permeation and segregation into vacuoles instead of phagocytosis. /31/Not specific. /32/May be first step in disintegration. /33/Possibly by elaborating soluble antigenically active material for particulate antigens.

55. PROPERTIES AND FUNCTIONS OF WHITE BLOOD CELLS AND RELATED FORMS¹ (Continued)

Cell Type (A)	Physical and Chemical Properties (B)	Chemical Contents and Stain Reactions			Biological Properties and Functions (F)
		Nucleus and Cytoplasm (C)	Nucleus (D)	Cytoplasm (E)	
			Chemical Contents		
235	Do not exhibit chemotaxis. Are less sensitive to lower pH than other leukocytes.	Carbohydrase Lipase. Nuclease Proteinase No veridoperoxidase.			on H^+ depolarized. ic for bacteria, cells, tissue, parasites as well as foreign al dyes ic for lipids and then called histiocytes" or "foam cells" Inocytosis as large scavenger cells of nation. into, or are activated in, inflammation. s than other leukocytes, le in antibody formation, d with the intermediate me- n of blood and bile pigments, erol, and iron. n into epithelioid cells, for- cy type, or Langerhans type ells, and possibly into fibro- ed animals.
240			Stain Reactions Feulgen positive.	Neutral red vacuoles are dispersed in cytoplasm or form rosette about cyto- centrum. Acid hematein positive.	
245					
250					
255		Acid phosphatase. Alkaline phosphatase (low)	Chemical Contents	Cytoplasm: Ribonucleoprotein. Granular glycogen. Granules: Oxidase	May be phagocytic. Possesses slight motility. Form platelets by pseudopodial for- mation and disintegration of cyto- plasm.
260	Megakaryocyte		Stain Reactions	Cytoplasm: Exhibits metachromasia. Acid hematein positive. Granules: Iodophilic. Mitochondria: Sudan black B positive	
265					
270					

¹/Statement of a positive finding in this table does not necessarily imply a negative finding in the same respect elsewhere in the table. /2/Questioned. /3/Not specific. /33/Possibly by elaboration of soluble antigenically active material for particulate antigens.

55. PROPERTIES AND FUNCTIONS OF WHITE BLOOD CELLS AND RELATED FORMS (Continued)

Cell Type (A)	Physical and Chemical Properties (B)	Chemical Contents and Stain Reactions (CDE)	Biological Properties and Functions (F)
	Physical Properties (B)	Chemical Contents (CDE)	
275	Are negatively charged. Cathaphoretic velocity same as that of neutrophils. Chromomere traversed by ultra-violet rays. Chemical Properties Chromomere dissolves in acetic acid. Positive bird's test in acid hydrolysates.	Acid phosphomonoesterase; Ascorbic acid; Catalase; Dopamine oxidase; Histamine; Oxidase; Peptolytic enzymes; No veridoxidase; No phosphatase; Granular glycoprotein; Lipids; Phospholipids; Cephalin, Free cholesterol, Cholesterol esters, Neutral fats, Ribonucleic Acid; Thromboplastin; Platelet accelerator factor; Vasoconstrictor substance; Hypotensive principle. Stain Reactions (CDE)	Release thromboplastin in clotting. Release accessory (accelerator) clotting factors. Interact with plasma antithrombotic factor to form thromboplastin. Possess agglutinative function, are sticky and adhesive, and lend these properties to the clot. Form capillary thrombi in test for bleeding time ^a when more than 30,000-60,000 per mm ³ . Adhere to microorganisms, "platelet loading." Associated with coarsening and shortening of fibrin strands in synovial fluid. Liberate a vasoconstrictor substance. Liberate a hypotensive principle which is stronger than vasoconstrictor substance. Support capillary walls in tourniquet tests when more than 30,000-60,000 per mm ³ , and endothelial cells are normal. In shed blood, transform into dendritic, then into expanded forms. In shed blood, contains fibrils which in turn are composed of spherules (50-200 millimicrons) disseminated into surrounding medium. Consists of bils of megakaryocyte cytoplasm. Oxygen consumption of platelets in men is 84 mm ³ per mg per hr. Life span in blood is 3-5 days.
280		Granules: Iodophilic	
285	Acid hematein positive. Sudan black B positive. Feulgen negative. Neutral red positive bodies.	Chromomere: Methyl green negative. Vitalomere: Methyl green positive. Pyronin negative.	
290			
295			
300			

1/Statement of a positive finding in this table does not necessarily imply a negative finding in the same respect elsewhere in the table. 2/Questioned. 3/In rabbits. 4/35/in horses. 5/38/15% of dried weight consists of lipids. 6/37/68% of phospholipids is cephalin. 7/38/Critical level in dispute. 8/39/Varies with both mammalian and bacterial species involved.

55. PROPERTIES AND FUNCTIONS OF WHITE BLOOD CELLS AND RELATED FORMS (Continued)

Cell Type (A)	Physical and Chemical Properties (B)	Chemical Contents and Stain Reactions			Biological Properties and Functions (F)
		Nucleus and Cytoplasm (C)	Nucleus (D)	Cytoplasm (E)	
303	Relatively resistant to irradiation HN, and to toxic stimuli of all varieties. Tendency to mat and to form colonies in vitro		Stain Reactions	Cytoplasm proper: May have azure granules in smears. Granules: Hematoxylin granules. Argemone Sudan black B.	Possess pseudopodial migration. Form stromal support for hematopoietic tissues. Line sinuses of bone marrow, lymph nodes, and spleen. Line sinusoids of liver, adrenal cortex, and possibly anterior lobe of pituitary gland. Associated with intermediate metabolism of blood and bile pigments, constant and iron. Stem cells for myeloblasts, monoblasts, megakaryoblasts, lymphoblasts, promyeloblasts, promegakaryoblasts, and plasmablasts. Form osteoblasts and possibly osteoclasts. May form cartilage cells (chondrocytes). Form osteocytes. Transform into adipose cells. Form argyrophil (reticular) fibers. Possess all functions ascribed to histocyte.
310	Reticulum Cell (Mesenchymal cell).				
315					
320					
325					
330	Relatively resistant to irradiation and HN.	Alkaline phosphatase. No peroxidase.	Chemical Contents	(Cytoplasm proper: Acid phosphatase. Ribonucleoprotein. Mucoprotein. Russell bodies. Peroxidase. Macroprotein. Ribonucleic acid)	Are not phagocytic. May show marked peripheral cytoplasmic dissolution. Participate in antibody formation after resection of antigen. Participate in antibody formation after simple injection of antigens. Secrete γ -globulins and mucoglobulins. May transform into plasma mast cells.
335					
340			Stain Reactions	Neutral red vacuoles may be arranged as rosettes about cytoplasmic center. Stains red with Unna's stain. Pyronin of methylene green-pyronin positive. Acridine red of malachite green-acridine-red positive. Russell bodies stain pink with H & E.	
345					
350					

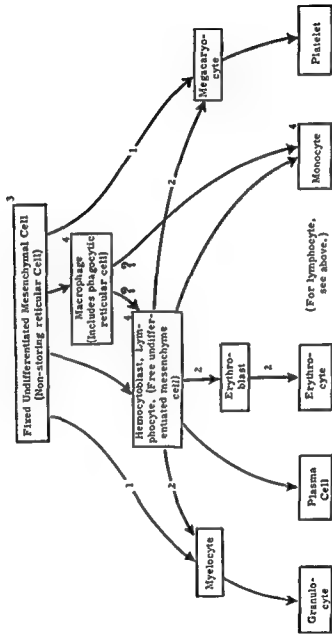
1/Statement of a positive finding in this table does not necessarily imply a negative finding in the same respect elsewhere in the table. 2/Questioned. 25/May be first step in disintegration. 40/No longer serve as stem cells except pathologically. 41/Usually.

55. PROPERTIES AND FUNCTIONS OF WHITE BLOOD CELLS AND RELATED FORMS¹(Concluded)

Cell Type (A)	Physical and Chemical Properties (B)	Chemical Contents and Stain Reactions			Biological Properties and Functions (F)
		Nucleus and Cytoplasm (C)	Nucleus (D)	Cytoplasm (E)	
353		Vitamin A. Free alpha amino acid groups.		Cytoplasm proper: Fine, granular, glycogen. Hof: Phospholipids, Alkaline phosphatase negative.	Exhibit frequent cytoplasmic bud- ding. May form Russell bodies. Cells often associated with abnor- mally increased plasma globulins. Cells often associated with abnormal plasma protein formation (Hence- Jones protein). Produce less globulin than mature plasma cells.
360	Myeloma Cells				
365				Stain Reactions Hof: Janus green B post- itive Sudan black B post- itive Sudan IV positive. Nile blue sulphate positive. Smith-Dietrich positive.	
370					

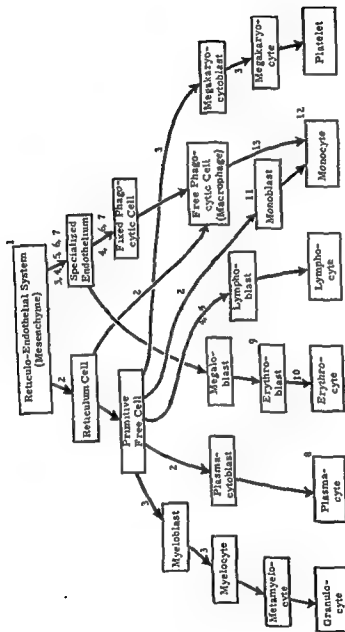
¹/Statement of a positive finding in this table does not necessarily imply a negative finding in the same respect elsewhere in the table. /2/Questioned.
/25/May be first step in disintegration. /12/Usually considered to be a malignant form of plasmacytic series.

56. GENEALOGY OF THE FORMED ELEMENTS OF BLOOD
Monophyletic Theory, William Bloom, (1952)



/1/ In ectopic myelopoiesis. /2/ Normally in bone marrow, in lymphatic and other tissues in ectopic myelopoiesis. /3/ Also gives rise directly to the fibroblast, fat cell, chondrocyte, osteoblast, and in the embryo, to the tissue mast cell and the endothelial cell. The fibroblast, chondrocyte, and osteoblast each may give rise to the osteocyte which in turn may give rise to the osteoclast, and thus to the reticular cell. Whether fibroblasts can become non-storing reticular cells in mammals is not clear. /4/ Gives rise in tissue culture and inflammation to the macrophage, and thus to the fibroblast.

58. GENEALOGY OF THE FORMED ELEMENTS OF BLOOD
Polyphyletic (Dualist) Theory, Charles A. Donn, (1952)



/1/ Also gives rise to the lipoblast which gives rise to the fat cell, both the former and the latter cells are found in special fat organs, diffuse connective tissue and bone marrow. /2/ In diffuse connective tissue and organ parenchyma. /3/ In bone marrow. /4/ In lymph nodes. /5/ In spleen. /6/ In Kupffer cells in liver. /7/ In endothelium (or sinusoids) of locations cited. /8/ Rare in blood, more common in connective tissue. /9/ Both early and late forms. /10/ Genealogical sequence from erythroblast to normoblast, reticulocyte and erythrocyte. /11/ May give rise to myeloblast in tissue culture. /12/ May give rise to fibroblast like cell in tissue culture and may revert to monoblast on demand. Monocyte also may give rise to epithelioid cell in fatty degeneration (of tuberculous caseation) and to the Langhans giant cell. /13/ On demand. There is evidence that macrophage may also give rise to fat cell or the reverse.

59. NOMENCLATURE RECOMMENDED¹ FOR CELLS OF BLOOD AND BLOOD-FORMING ORGANS

Specific Cell Type				Terms to be avoided		Specific Cell Type		Terms to be avoided		Specific Cell Type		Terms to be avoided	
General Cell Type		Term to be used		Term to be avoided		General Cell Type		Term to be used		General Cell Type		Term to be avoided	
(A)		(B)		(C)		(A)		(B)		(C)		(D)	
Erythrocytic Series	1	Rubriblast		Erythroblast, megakaryoblast, promonoblast, hemocytoblast, stem cell, myeloblast, lymphoblast, karyoblast	13	Erythroblast, megakaryoblast, promonoblast, hemocytoblast, stem cell, myeloblast, lymphoblast, karyoblast		Myeloblast	progranulocyte	Granulocyte myelocyte B, non-filament, class I	Granuloblast, hemocytoblast, lymphoblast, stem cell	Promyelocyte II, leukoblast, promyeloblast, promonocyte, promyelocyte, promonocyte, promyelocyte A	
	2	Proerubricyte		Erythroblast, megakaryoblast, promonoblast, hemocytoblast, stem cell, myeloblast, lymphoblast, karyoblast	14	Erythroblast, megakaryoblast, promonoblast, hemocytoblast, stem cell, myeloblast, lymphoblast, karyoblast		Myelocyte	Metamyelocyte	Metagranulocyte, juvenile, non-filament, class I	Metagranulocyte, juvenile, non-filament, class I	Metagranulocyte, juvenile, non-filament, class I	
	3	Rubricyte		Erythroblast, megakaryoblast, promonoblast, hemocytoblast, stem cell, myeloblast, lymphoblast, karyoblast	15	Erythroblast, megakaryoblast, promonoblast, hemocytoblast, stem cell, myeloblast, lymphoblast, karyoblast		Band Cell	Segmented	Polymorphonuclear, filamented, class II, III, IV, or V, lobocyte	Polymorphonuclear, filamented, class II, III, IV, or V, lobocyte	Polymorphonuclear, filamented, class II, III, IV, or V, lobocyte	
	4	Lymphoblast		Large lymphocyte, pathological lymphocyte, atypical lymphocyte, immature lymphocyte	16	Large lymphocyte, pathological lymphocyte, atypical lymphocyte, immature lymphocyte		Plasmablast	Plasmacyte	Turk cell, Turk irritation form, lymphoblastic or myeloblastic plasma cell, myeloma cell	Turk cell, Turk irritation form, lymphoblastic or myeloblastic plasma cell, myeloma cell	Turk cell, Turk irritation form, lymphoblastic or myeloblastic plasma cell, myeloma cell	
	5	Prolymphocyte		Small, medium, or large lymphocyte, normal lymphocyte, small, medium, or large mononuclear	17	Small, medium, or large lymphocyte, normal lymphocyte, small, medium, or large mononuclear		Megakaryoblast	Promegakaryocyte	Megakaryocyte	Megakaryocyte	Megakaryocyte	
	6	Lymphocyte		Mieloblast, hemocytoblast, lymphoblast, stem cell, myeloblast, lymphocyte	18	Mieloblast, hemocytoblast, lymphoblast, stem cell, myeloblast, lymphocyte		Thrombocyte	Disintegrated cell	Senile cell, mudger, basket cell, smear cell, degenerated cell	Senile cell, mudger, basket cell, smear cell, degenerated cell	Senile cell, mudger, basket cell, smear cell, degenerated cell	
	7	Monocyte		Large mononuclear, transitional monocyte, endothelial leukocyte, histiocyte, resting wandering cell	19	Large mononuclear, transitional monocyte, endothelial leukocyte, histiocyte, resting wandering cell		Not identifiable	Not identifiable	Not identifiable	Not identifiable	Not identifiable	

¹. By the Committee for Clarification of the Nomenclature of Cells and Diseases of the Blood and Blood-forming Organs. This Committee is sponsored by the American Society of Clinical Pathologists and by the American Medical Association. [2/ It is recommended that the reticulocyte stage be considered a subdivision of the erythrocyte stage.]

60. BONE MARROW (STERNAL) DIFFERENTIAL CELL COUNT: MAN

[illegible][illegible]

61. BONE MARROW (STERNAL)¹ DIFFERENTIAL CELL COUNT.
SUMMARY: MAN²

Cell Types			Value ^{3,5} %	Range ^{4,5} %
			(D)	(E)
(A)	(B)	(C)		
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17	Red Series 19.1%	Proerythroblasts Early Normoblasts Intermed. Normoblasts Late Normoblasts	0.5 2.4 11.7 4.5	0.2 - 4.0 1.5 - 5.8 5.0 - 26.4 1.6 - 21.5
	Early 2.9%			
	Late 16.2%			
	Granulo- cytic 57.4%	Myeloblasts	1.2	0.3 - 3.1
		Progranulocytes	3.0	0.5 - 4.5
		Myelocytes	8.7	0.9 - 20.3
		Metamyelocytes	11.0	5.6 - 22
		Band Cells	17.9	6.1 - 36
		Segmented Cells	15.6	8.7 - 27
	Others 12.6%	Lymphocytes	9.8	2.7 - 24
		Monocytes	1.4	0.7 - 2.8
		Megakaryocytes	0.2	0.03 - 0.4
		Plasmacytes	0.6	0.1 - 1.5
		Reticulum Cells	0.6	0.03 - 1.6
	Not Identifiable 10.9%	Unclassified Cells Disintegrated Cells	1.7 9.2	0.02 - 3.3 1.1 - 20.8

/1/ Sternal aspirations of 0.1-10.0 ml of bone marrow. /2/ Men and women, 750 adults. /3/ Grand mean of 21 authors' means.
/4/ Range of authors' means. /5/ These values are averages of results from different laboratories using different techniques.
Values from any one laboratory may be expected to show a consistent departure from the averages.

62. BONE MARROW (STERNAL) DIFFERENTIAL CELL COUNT IN PREGNANCY: MAN

Cell Types	First Trimester				Second Trimester				Third Trimester			
	Cells per mm ³		% of Total		Cells per mm ³		% of Total		Cells per mm ³		% of Total	
	Value	Range	Value	Range	Value	Range	Value	Range	Value	Range	Value	Range
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)
1 Proerythroblasts ("Rubriblasts")	56	0-136	0.2	0-0.4	73	0-203	0.2	0-0.4	61	0-210	0.1	0-0.4
2 Early Normoblasts ("Proerythrocytes")	749	84-1,316	2.3	0-3.2	777	251-1,875	2.0	1.0-4.0	1,055	51-3,337	2.5	0.5-4.0
3 Intermediate Normoblasts ("Archiepocytes")	1,139	259-2,628	2.3	1-5.0	1,803	314-7,000	4.0	2.0-6.4	1,465	51-4,056	3.5	0.5-4.0
4 Late Normoblasts ("Metarubricytes")	940	28-2,769	2.2	0.2-6.0	835	259-2,000	2.2	0.4-7.0	856	119-2,730	2.2	0.4-7.0
5 Myeloblasts	65	0-128	0.1	0-0.9	172	0-1,200	0.2	0-1.0	96	0-423	0.2	0-1.0
6 Erythrocytes	252	38-678	0.7	0-1.5	446	0-3,108	0.7	0-2.0	562	81-1,919	0.7	0-2.0
7 Myelocytes, Eosinophilic	235	28-678	0.7	0.2-2.6	353	0-3,108	0.6	0-1.6	367	0-1,060	0.6	0-1.6
8 Myelocytes, Neutrophilic	2,342	372-4,256	6.0	1.2-10.6	3,229	659-12,125	7.0	4.0-11.2	2,138	391-7,327	5.0	1.0-10.0
9 Metamyelocytes, Neutrophilic	2,345	259-5,913	5.7	1.0-9.0	2,823	291-10,250	5.4	1.0-9.0	1,879	340-4,900	4.5	1.0-10.0
10 Band Neutrophils	11,659	2,189-24,233	30.2	9-50.0	17,315	4,187-46,250	45.0	10-60.0	11,613	4,102-29,100	28.0	10-40.0
11 Segmented Eosinophils	371	48-1,140	1.3	0.2-6.0	299	18-799	0.8	0.1-1.0	228	30-700	0.6	0-1.0
12 Segmented Basophils	78	0-197	0.3	0-0.8	6,467	1,484-10,000	12.9	6-20	49	0-792	0.1	0-0.4
13 Lymphocytes	3,975	2,894-6,300	13.5	4.5-28.0	4,467	1,484-10,000	12.9	6-20	5,719	1,111-9,500	14.0	4-20.0
14 Monocytes	433	3-965	1.1	0.1-3.0	4,573	0-11,645	9.7	0-23.5	4,154	1,377-11,135	10.0	4-20.0
15 Unidentified Cells	24	0-60	0.0	0-0.1	91,510	11,700-125,000	18.4	4-30.0	33,910	10,500-70,000	82.0	40-90.0
16 Total Unidentified Cells	24	0-60	0.0	0-0.1	91,510	11,700-125,000	18.4	4-30.0	33,910	10,500-70,000	82.0	40-90.0
Cell Types	First Trimester				Second Trimester				Third Trimester			
	Cells per mm ³		% of Total		Cells per mm ³		% of Total		Cells per mm ³		% of Total	
	Value	Range	Value	Range	Value	Range	Value	Range	Value	Range	Value	Range
(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)
1 Proerythroblasts ("Rubriblasts")	0.2	0-0.5	64	0-210	0.2	0-0.1	26	0-132	0.1	0-0.4	0.1	0-0.4
2 Early Normoblasts ("Proerythrocytes")	2.8	0.3-6.2	864	81-3,937	2.4	0.3-6.2	416	43-1,596	2.5	0.5-4.0	2.5	0.5-4.0
3 Intermediate Normoblasts ("Archiepocytes")	5.2	0.3-13.4	1,462	51-8,636	4.3	0.3-13.4	1,199	134-2,956	5.0	1.0-10.0	5.0	1.0-10.0
4 Late Normoblasts ("Metarubricytes")	2.6	0-6.5	863	28-2,730	2.3	0.2-7.0	453	41-1,089	1.9	0.4-3.2	1.9	0.4-3.2
5 Myeloblasts	0.2	0-0.1	115	0-1,250	0.2	0-0.1	89	0-279	0.3	0-0.8	0.3	0-0.8
6 Erythrocytes	0.9	0-2.3	293	0-2,000	0.9	0-2.3	251	11-756	1.0	0.1-2.3	1.0	0.1-2.3
7 Myelocytes, Eosinophilic	0.6	0-1.0	209	0-1,408	0.5	0-2.6	157	0-630	0.5	0-1.4	0.5	0-1.4
8 Myelocytes, Neutrophilic	5.9	2-12.5	2,552	172-12,125	4.3	1.2-12.5	1,564	168-4,140	6.0	1-11.0	6.0	1-11.0
9 Metamyelocytes, Neutrophilic	5.3	2-9.0	2,411	255-19,150	5.1	1-9.0	1,937	188-4,354	5.6	1-9.4	5.6	1-9.4
10 Band Neutrophils	34.9	2.3-45.0	10,415	2,389-46,250	33.3	15-48.0	6,048	1,071-14,490	33.7	12-43.6	33.7	12-43.6
11 Segmented Eosinophils	8.7	0-16.6	5,112	394-21,700	15.7	3.8-38.0	3,565	3,132-7,094	16.6	10-43.3	16.6	10-43.3
12 Segmented Basophils	0.2	0-0.6	56	0-197	0.2	0-0.1	55	0-642	0.2	0-0.4	0.2	0-0.4
13 Lymphocytes	12.0	5-23.3	4,865	1,318-10,000	12.7	4.5-28.0	3,628	1,721-4,520	16.8	9.2-23.0	16.8	9.2-23.0
14 Monocytes	0.7	0-0.2	246	0-965	0.8	0-3.0	312	32-717	1.6	0-3.5	1.6	0-3.5
15 Unidentified Cells	13.2	5-23.6	4,599	1,037-11,000	12.9	5-23.6	3,578	1,081-4,534	16.2	10-24.0	16.2	10-24.0
16 Total Unidentified Cells	13.2	5-23.6	4,599	1,037-11,000	12.9	5-23.6	3,578	1,081-4,534	16.2	10-24.0	16.2	10-24.0

/1/ 40 pregnant females and 28 non-pregnant females, 10 ml marrow aspirated. /2/ Includes eosinophilic metamyelocytes. /3/ Includes band eosinophils. /4/ Includes band eosinophils.

63. BONE MARROW (RIB) DIFFERENTIAL CELL COUNT: DOG

Author	Stasney & Huggins (1937)		Van Loon (1943)		Mulligan (1941)		Rakers & Coulter (1948)		Mulligan (1945)	
	Adult		Adult		Adult		19-24 mos.		0.5-2.5 days	
	35		81		35		36		21	
Age	Range		Range		Range		Range		Range	
Number of cases	Value	(C)	Value	(D)	Value	(E)	Value	(F)	Value	(G)
Cell count in per cent (%)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)
1 Myeloblasts	2.4	0-5.1b	0.6	0.2-1c	0.6	0-1.8c	1.9	0.2-3.7c	0.8c	0-2.2c
2 Early Myelocytes	2.8c	0-5.8b	1.6c	0.7-2.8c	1.5c	0.2-4.6c	2.7	0-9.5c	4.3	2.0-6.6c
3 Myelocytes, all			6.0	2.7-10c	4.7	2.2-11c				7-12c
4 Neutrophils	8.9	2.8-15b								15-28c
5 Eosinophils	1.2	0-2.4b	3.4	1.1-4.6c	10.5	5.6-20c	5.1	0-24c	9.7	0.8-6.6c
6 Metamyelocytes	15.3	7.2-23b	11.7	6.8-17c	31.0	17-54c	42.4	17-63c	20.6	0.5-2c
7 Band Cells										
8 Segmented Cells	5.1	0-12.5b	30.1	17-44c	3.9	0.2-8.5c	5	0.2-14c	3.4	0.8-6.6c
9 Neutrophils	2.8	0-6.8b	2.0	0.4-3.8c	3.7c	1-6.8c	4.7c	0.2-19c	2.4c	0.5-2c
10 Eosinophils	0.1	0-0.3b					0.2	0-1.3c	3.3	1.6-6c
11 Basophils	1.2	0-2.2b					0.7	0-8c		
12 Lymphocytes	0.1	0-0.5b	0.5	0.2-2.7c	0.5c	0-6.6c	0.6	0-1.1c		
13 Monocytes			0.6c	0.2-2.7c	1.9		0.6	0-1.1c	1.3c	0.4-3.2c
14 Megakaryocytes							0.35	0-1.3c		
15 Proerythroblasts										
16 ("Rubricytes")										
17 Early Normoblasts	40-70b		7.8c	6.4-10c	1.5c	0.4-3.8c	28.2c	8-54c	5.8c	3-9.5c
18 ("Prorubricytes")										
19 Intermed. Normoblasts			16.4c	11-26c	38.18.9	19-64c			45.18.9	33-57c
20 Late Normoblasts			17.4c	9-26c						
21 ("Rubricytes")										
22 ("Metarubricytes")										
23 Plasmacytes	1.	0-2.1b			2.1	0.8-6.1c	3	0-16c	3.1	0.8-5.4c
24 Reticulum Cells	0.211	0-0.7b								
25 Unclassified Cells										
26 Total Nucleated Cells (millions/mm ³)										

/1/ Includes "Leukoblasts." /2/ Promyelocytes. /3/ Eosinophilic cells, all forms. /4/ Pronormoblasts. /5/ Megakaryoblasts.
 /6/ Basophilic normoblasts. /7/ Erythroblasts. /8/ Polychromatic normoblasts. /9/ Orthochromatic normoblasts. /10/ Normoblasts.
 /11/ Includes "Heterophils." /12/ Mean of the means. /13/ Range of the means.

64. BONE MARROW (RIB)¹ DIFFERENTIAL CELL COUNT, SUMMARY: DOG²

Cell Types				Value ^{4,6} %	Range ^{5,6} %
(A)		(B)	(C)	(D)	(E)
1	Red Series 43.6%	Early	Proerythroblasts	0.5	0.3 - 0.6
2		5.4%	Early Normoblasts	4.9	1.5 - 7.8
3		Late	Intermed. Normoblasts	22.3	11.0 - 26.
4		38.2%	Late Normoblasts	15.9	4.6 - 17.4
5	White Series and Others 54.9%	Granulo- cytic 52.2%	Myeloblasts	1.2	0.6 - 2.4
6			Early Myelocytes, Neutrophil.	1.4	0.7 - 2.8
7			Myelocytes, Neutrophilic	4.8	2.7 - 8.9
8			Metamyelocytes, Neutrophilic	7.4	3.4 - 15.3
9			Band Cells, Neutrophilic	24.6	11.7 - 42
10			Segmented Cells, Neutrophil. ³	9.6	3.9 - 30
11		Eosinophilic Cells, all types	3.1	2.0 - 4.7	
12		Others 2.7%	Lymphocytes	0.9	0.7 - 1.9
13			Monocytes	0.2	0.0 - 0.2
14			Megakaryocytes	0.4	0.1 - 0.6
15	Plasmacytes		0.3	0.0 - 0.4	
16		Reticulum Cells	0.9	0.0 - 1.0	
17	Not Identifiable				
18	1.5%		Unclassified Cells	1.5	0.0 - 3.0

/1/ Rib extrusions. /2/ 187 adult dogs. /3/ Includes basophilic cells (0.05-0.2 range of means). /4/ Grand mean of 4 authors' means.

/5/ Range of 4 authors' means. /6/ These values are averages of results from different laboratories using different techniques. Values from any one laboratory may be expected to show a consistent departure from the averages.

65. MORPHOLOGY OF FORMED ELEMENTS OF BONE MARROW: MAN¹

CYTOPLASM

Cell Type	Size μ	Granules	Relative Amount	Color
(A)	(B)	(C)	(D)	(E)
1 Reticulum cell (Reticulo-endothelial cell, Stern cell of modern pathologists, Mesenchymal cell, Hemohistioblast)	15-25			Pale to dark blue; may be mottled with abundant, colorless, or slightly acidophilic hyaloplasm.
2 Myeloblast* (Hemocytoblast, Stern cell of classic hematologists)	10-18	May or may not contain fine, angular, purple, azurophil granules	Usually a narrow band	Pale to dark blue.
3 Progranulocyte* (Leukoblast, "Myeloblast" of Italian authors)	14-21 mean = 17	May or may not contain fine, angular, purple, azurophil granules; are less commonly round and larger; may be numerous; may overlie nucleus.	Usually moderate; more than myeloblast.*	Varying shades of blue but usually pale blue or mottled.
(Early) Myelocyte* (Promyelocyte)		May or may not contain azurophil granules. At this stage the first few specific granules are seen.*		
4 (a) Neutrophilic	12-18	(a) Pink specific granules first appear about cytocentrum; may show diffuse pink masses of neutrophilic substances.	Usually moderate to abundant.	Varying shades of blue, usually pale; paler areas in region of cytocentrum, darker at periphery.
(b) Eosinophilic		(b) Round, red, large specific granules; a few early ones are blue to purple.		
(c) Basophilic		(c) Few very large, metachromatic, specific granules; vary in size; water soluble.		
5 (Late) Myelocyte (a) Neutrophilic	10-16	(a) Specific granules are pink and more numerous than in early myelocyte	Moderate to abundant.*	(a) Usually clear or colorless
(b) Eosinophilic		(b) Specific granules are red and more numerous than in early myelocyte		(b) May be pale blue.
(c) Basophilic		(c) Specific granules are metachromatic and more numerous than in early myelocyte		(c) May be pale blue.

¹/1 Table applies only to elements as observed in ordinary air-dried smears after Romanowsky stains. For characteristics of the corresponding elements as observed in tissue sections and moist smears, refer to Chapter 5, Maximow, A., and Bloom, W., "A Textbook of Histology," W B Saunders, Philadelphia, 1948. For characteristics of the corresponding elements as observed with the supravital technique, refer to Tompkins, E. H., and Cunningham, R. S., in Sections IX and X in Vol. I of "Handbook of Hematology," Hal Downey, Ed.

65. BONE MARROW MORPHOLOGY¹ (Continued)

NUCLEUS					
Shape	Position	Nuclear Membrane	Nucleoli	Chromatin Pattern	Parachromatin Pattern and Amount
(F)	(G)	(H)	(I)	(J)	(K)
Round, oval, reniform, or rarely indented	Central or eccentric	Moderately thin	0-6; usually 3-6; round irregular	Irregular network of light, red-violet	Small amount; pink or pale blue; fills irregular clefts in chromatin interstices; abundant and distinct from chromatin
			ance.	unequal in size.	
Round or oval	Usually central	Very thin and indistinct	0-5, pale blue, round or oval, occasionally irregular, chromatin may delimit nucleoli	Fine network of chromatin strands with regular, equal, small interstices; chromatin strands are thin, or the pattern may appear as one of fine regular stippling, no clumping; stains a light lavender.	Small amount; fine pink or pale blue parachromatin in small interstices of chromatin; distinct from chromatin.
Round or oval	Central or eccentric.	Thin	periphery	of chromatin, especially about nucleoli	
Round or oval	Central or eccentric	Thin	Occasionally present, usually not visible; when present, pale blue and round or oval	Network of chromatin filaments, slightly coarsened with less regular interstices	Small amount; pale blue or pink; distinct from chromatin
Round or oval	Central or eccentric	Distinct, thick	None visible	Thickened chromatin strands form a coarse meshwork, staining a deep purple	Small amount; pale blue or pink; distinct from chromatin


tor, Paul B. Hoerber, New York, 1933 /2/ Nomenclature recommended by Committee for Classification of the Nomenclature of Cells and Diseases of the Blood and Blood-forming Organs (Blood 4:89, 1949) /3/ Vacuoles are common in cytoplasm, may have clear ectoplasm /4/ Abundant hyaloplasm /5/ All characterized by specific granules and basophilic spongioplasm /6/ All characterized by increase in colorless hyaloplasm and in specific granules

65. BONE MARROW MORPHOLOGY¹ (Continued)

CYTOPLASM				
Cell Type	Size μ	Granules	Relative Amount	Color
(A)	(B)	(C)	(D)	(E)
6 Metamyelocyte* (Juvenile) (a) Neutrophilic	10-16	(a) Specific granules are pink to rose-violet and more numerous than in late myelocyte.	Abundant	Colorless or slightly acidophilic.
(b) Eosinophilic		(b) Specific granules are red and more numerous than in late myelocyte.		
(c) Basophilic		(c) Specific granules are metachromatic and more numerous than in late myelocyte.		
7 Granulocyte, neutrophilic, band (Regenerative).	(See Table on Morphology of Blood Leukocytes and Platelets: Man)			
8 Granulocytes, segmented: Neutrophilic Eosinophilic Basophilic.				
9 Lymphoblast*	10-18	Azurophil granules are usually absent	Usually forms narrow band; may have large cell body†	Varying shades of pale to dark blue.
10 Prolymphocyte* (Immature lymphocyte).	10-18	Azurophil granules may or may not be present; usually absent.	Usually forms very narrow band, may have large cell body	Varying shades of pale to dark blue.
11 Lymphocyte Small Medium	(See Table on Morphology of Blood Leukocytes and Platelets: Man)			
12 Leukocytoid Lymphocyte (Pathological lymphocyte, e.g., as in infectious mononucleosis)	10-16	May or may not contain round, purple azurophil granules. Granules, if present, may be small or large, sparse or numerous	May have increased azurophilic granules	

/1/ Table applies only to elements as observed in ordinary air-dried smears after Romanowsky stains
 /2/ Nomenclature recommended by Committee for Clarification of the Nomenclature of Cells and Diseases of

65. BONE MARROW MORPHOLOGY¹ (Continued)

NUCLEUS					
Shape	Position	Nuclear Membrane	Nucleoli	Chromatin Pattern	Pattern and Amount Parachromatin
(F)	(G)	(H)	(I)	(J)	(K)
Reniform, moderately indented	Central or eccentric	Thick, heavy	None visible	Thickened chromatin strands form a coarse meshwork, staining a deep purple	Small amount; pale blue or pink, distinct from chromatin in the interstices of the latter
Round or oval	Usually central	Thin	0-5, usually 1-2; pale blue, small, round, chromatin does not mass about nucleoli	<p>Fine network of chromatin strands with regular, small interstices. Chromatin strands are thin, or</p>  <p>reticular filaments</p>	Small amount; fine pink or pale blue, in small interstices of chromatin; dis-
Round, oval, or reniform, slightly indented	Central or eccentric	Thin to thick	Occasional blue, round, unmasked nucleolus	In some areas, fine to coarse network of chromatin strands, such areas blend imperceptibly with areas with indistinct, coarse, clumped chromatin masses	Small amount, pale blue, in some areas still distinct; in other areas blends with chromatin.
Round, oval, deeply indented, reniform, or irregular	Usually eccentric	Thick		Pattern may be lymphocyte-like (11J) if accompanied by extensive cytoplasmic changes, or pattern may be plasmacytic,	Varying amounts of

the Blood and Blood-forming Organs (Blood 4 89, 1949) /7/ Cytoplasm is homogeneous /8/ Downey recognized three cell types on the basis of these characteristics

65. BONE MARROW MORPHOLOGY¹ (Continued)

CYTOPLASM

Cell Type		Size μ	Granules	Relative Amount	Color
(A)		(B)	(C)	(D)	(E)
13	Monoblast ²	14-18	May or may not contain fine azurophilic granules.	Moderate or abundant.	Slightly basophilic or gray.
14	Monocyte ² (Transitional or Blood mononuclear)	(See Table on Morphology of Blood Leukocytes and Platelets: Man)			
15	Megakaryoblast ²	circa 15-50	Usually absent. A few coarse granules may be present.	As cell matures to promegakaryocyte, amount varies from narrow band to abundant.	Varying shades of blue. Usually zoned in lighter and darker areas. ²
16	Promegakaryocyte ^{2,u}	circa 18-50	Azurophilic granules begin to make their appearance near cytocentrum and spread through cell body.	Usually abundant.	Basophilic, but becomes paler blue as maturation approaches.
17	Megakaryocyte ²	circa 30-70	Azurophilic granules	Large amounts Pseudopodial processes frequent	Pale blue. May begin
18	Thrombocyte (Platelet)	(See Table on Morphology of Blood Leukocytes and Platelets: Man)			
19	Promyeloblast ² or Proerythroblast (Megakaryoblast of Supravitalists, Rubriblast) ²	10-15	Usually absent.	Usually narrow band; ordinarily not quite as much as myeloblast, but both vary; almost always less than promegakaryoblast (24D).	Basophilic; stains deeply blue and is usually more homogeneous and condensed than that of myeloblast or promegakaryoblast; may have clear perinuclear zone.
				Because of shrinking of	Basophilic; stains

65. BONE MARROW MORPHOLOGY¹ (Continued)

NUCLEUS					
Shape	Position	Nuclear Membrane	Nucleoli	Chromatin Pattern	Parachromatin Pattern and Amount
(F)	(G)	(H)	(I)	(J)	(K)
Round, oval, may be indented	Central or eccentric				
Round, oval, reniform or indented. Rarely multinucleated.	Central or eccentric.	Thin	0-10, pale blue, well circumscribed.	more darkly than myeloblast pattern	work.
Irregular or polylobular. Rarely multinucleated	Usually eccentric	Thin	Usually less numerous than megakaryoblast, (151) but may still be very numerous	Stains more heavily than megakaryoblast; a regular distinct network remains but chromatin threads are coarser than in megakaryoblast and may show areas of clumping.	Small amount of pink between chromatin strands where they are not clumped
Markedly multi-lobular and complicated in form, less frequently round, oval, or multinuclear.	Central or eccentric	Thick, heavy	None visible	visible	chromatin may be seen
Round or oval	Central or eccentric	Very thin	Present but faint; appear to be dissolved out; give blue tint.	Similar to that of myeloblast (2J) but chromatin strands forming network are slightly thicker and there is some clumping, thus appearing more heavily stained, interstices are distinct but slightly irregular.	Small amount, less than myeloblast and much less than promegaloblast, stains pink and is distinct from chromatin
Round and smaller than pronormoblast	Central or eccentric	Thin	May still be present though usually none visible	Network now com-	Small amount; ar-

usually identified by "the company it keeps" /10/ Light area of hyaloplasm around nucleus /11/ Large cells of this group are called Intermediate Megakaryocytes /12/ Nucleus larger than megakaryocyte. /13/ There is a gradual decrease in nuclear size due to condensation as all the following cells in this series differentiate

65. BONE MARROW MORPHOLOGY¹ (Continued)

CYTOPLASM				
Cell Type	Size μ	Granules	Relative Amount	Color
(A)	(B)	(C)	(D)	(E)
21 Polychromatophilic Normoblast ¹⁴ or Polychromatophilic Erythroblast (Late Rubricyte) ²	circa 8-12	Absent	Because of shrinking	Hemoglobin first appearing in nuclear areas
22 Orthochromatic or Acidophilic Normoblast. (Metarubricyte) ¹	circa 7-10	Absent	Because of condensed nucleus, cytoplasmic to nuclear ratio is increased but is less than that of orthochromatic megaloblast.	Red, homogenous, and smooth because of hemoglobin predominance.
23 Erythrocyte ¹⁵	7.2-7.8 mean = 7.5	Absent	Non-nucleated corpuscle formed by loss of nucleus from the orthochromatic normoblast.	Orange-red hemoglobin; center is slightly paler than periphery.
24 Promegaloblast ¹⁴ (Rubriblast, Pernicious Anemia type)	13-25	Usually absent		
25 Basophilic Megaloblast (Prorubricyte, P.A. type and Rubricyte, P.A. type) ¹	13-20	Absent		
26 Polychromatophilic Megaloblast (Rubricyte, late, P.A. type) ¹	Usually 10-18 (May be much larger).	Absent		Varying amounts of acidophilic (red)
27 Orthochromatic Megaloblast ¹⁴ (Late Rubricyte, P.A. type and Metarubricyte, P.A. type) ¹	Usually 8-15 (May be much larger)	Absent		

65. BONE MARROW MORPHOLOGY¹ (Continued)



NUCLEUS

Shape	Position	Nuclear Membrane	Nucleoli	Chromatin Pattern	Parachromatin Pattern and Amount
(F)	(G)	(H)	(I)	(J)	(K)
Round but smaller than basophilic normoblast	Central or eccentric	Thick	None visible.	Chromatin strands so coarse that in many places they are condensed into masses; they may be arranged as wheel-spokes ("rad-kern")	Small amount; arranged as pink, irregular chinks in interstices of chromatin
Round but smaller than polychromatophilic normoblast.	Central or eccentric	Thick, coarse, heavy	None visible	Nucleus is condensed, no longer in any pattern visible	May either be absent or one or two pink chinks may still remain
Round or oval	Central or eccentric.	Very thin, indistinct		Delicate structure, almost none visible	More abundant than in myeloblast and much more than in pronormoblast. Appears as pink, comma-shaped areas distinct from chromatin.
Round and about same size as promegaloblast	Central or eccentric	Thin	Nucleoli often absent but they are more often present than in corresponding basophilic normoblast.		
Round	May be central but usually eccentric	Thin to thick.	May still be present, usually none visible.	Pattern remains the same as in the basophilic megaloblast; i.e., there is a slightly coarsened network with prominent interstices. Reticular structure still evident.	Remains abundant, pink; fills interstices in chromatin network from which it is distinct.
Round	Usually eccentric.	Thick	May still be present; usually	Pattern shows all gradations from a slightly coarsened network with numerous distinct interstices to	Parachromatin is pink; varies from abundant, when chromatin interstices are large to

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65. BONE MARROW MORPHOLOGY¹ (Continued)

CYTOPLASM

Cell Type		Size μ	Granules	Relative Amount	Color
(A)		(B)	(C)	(D)	(E)
28	Megalocyte ^{1a}	Greater than 7.8	Absent	Non-nucleated corpuscle formed from the cytoplasm of the orthochromatic megaloblast, often pear-shaped.	Orange-red hemoglobin; homogeneous or slightly dark red through thicker center.
29	Plasmablast ^{1a,1b} (Reticular plasma cell).	25-40	Usually absent. (Azurophilic granules are rarely described in abnormal forms).	Large amounts.	Varying shades of blue, usually light blue or moderately deep; basophilic spongioplasm is mottled with bars of hyaloplasm (mitochondria); candelated appearance; Hof is indistinct; may show peripheral cytoplasmic dissolution.
30	Proplasmacyte ^{1a}	circa 15-30	Usually absent.	Abundant, but less than plasmablast.	With shrinkage of cytoplasm, basophilia become more prominent. An eccentric, clear, perinuclear area, or Hof, develops; may show peripheral cytoplasmic dissolution.
31	Plasmacyte ¹ (Marschalko plasma cell).	8-25	Usually absent.		Deep blue cytoplasm with large pale stain- 
32	Tissue Mast Cell ^{1a}	8-25	Entire cytoplasm is stuffed or packed with metachromatic granules ^{1a} which are spherical and uniform in size. May be so abundant as to mask nucleus; granules more water soluble than those of blood basophils.	Abundant; cytoplasmic to nuclear ratio favors the cytoplasm.	Colorless

65. BONE MARROW MORPHOLOGY¹ (Concluded)

NUCLEUS					
Shape	Position	Nuclear Membrane	Nucleoli	Chromatin Pattern	Parachromatin Pattern and Amount
(F)	(G)	(H)	(I)	(J)	(K)
Round or oval	Eccentric.	Thin	0 to 6, blue.	Irregular network of fine chromatin strands with irregular interstices. Resembles pattern of reticulum cell nucleus (1J) but has thicker strands and may show some clumping of chromatin.	Pink or yellow; distinct from chromatin strands; fills interstices of chromatin.
Round or oval and smaller than that of plasmablast.	Eccentric	Thin to thick.	1 or 2 nucleoli may still be present	Contraction of nucleus leads to further coarsening and thickening of reticular network; irregular interstices are still distinct.	Small amount; distinct in interstices of chromatin although interstices are irregular.
Round or oval; may be binucleate or multinucleate. Usually smaller than nucleus of proplasmacyte (30F).	Eccentric.	Thick	None visible.	Chromatin further condensed; tends to pyknosis. Coarse chromatin masses arranged often in smears or imprints.	Small amount; dis-
Small, round, or oval; may be binucleate.	Eccentric.	Varies in thickness.	None visible	Coarse chromatin masses arranged irregularly in clumps, or almost homogeneously	Small amount.

pute, the lymphocyte at times is considered to function as the plasmacyte precursor /20/ Cell outline may be spherical, ellipsoidal, or irregular. /21/ Metachromatic material is believed by some to be in the cytoplasm between the granules (Jaques).

66. HISTOCHEMICAL PROPERTIES OF BLOOD AND BONE MARROW CELLS: MAN

Cytoplasm proper (C); Specific Granules (G); Juxtanuclear bodies (J); Mitochondria (M); Nucleoli (N)							
Cell Type (A)	Lipid ¹ (B)	Phospho- lipid ² (C)	Acid Phosphatase ³ (D)	Alkaline Phosphatase ³ (E)	Ribonucleo- protein ⁴ (F)	Carbohydrate ⁵ (G)	Peroxidase ⁶ (H)
1 Nuclei (all types)	Neg	Neg	Pos	Pos ⁷	Pos N	Neg	---
2 Cytoplasm of:							
3 Myeloblasts	Pos M	Pos M	Neg	---	Pos C ⁸	Neg	Neg
4 Progranulocytes	Pos GM	Pos G ^{7M}	Pos G	Neg ⁹	Pos C ⁸	Neg ^{7,10}	Pos G
5 Myelocytes	Pos GM	Pos G ^{7M}	Pos GC	Neg ⁹	Neg	Pos ^{7,10}	Pos G
6 Metamyelocytes	Pos G	Pos G ⁷	Pos G	Pos C ^{8,10}	Neg	Pos ^{7,10}	Pos
7 Segmented neutrophils	Pos G	Pos G ⁷	Pos G	Pos C ^{8,10}	Neg	Pos G	Pos
8 Segmented eosinophils	Pos G	Pos G	Pos G	Neg	Neg	Pos G ¹⁰	Neg
9 Tissue eosinophils	Pos G	Pos G ⁷	---	---	---	Pos ⁷	Pos
10 Lymphoblasts	Pos M	Pos GM	Neg	Neg	Neg C ⁸	---	Neg
11 Lymphocytes	Neg	Neg	---	---	Pos C ⁸	Neg ¹³	Neg
12 Monocytes	Pos GM	Pos G	Pos JG	Neg ¹²	Pos C ⁸	Pos C	Pos ¹¹
13 Megakaryocytes	Pos GM	Pos G ^{7M}	---	---	---	Pos ¹⁰	---
14 Thrombocytes	Neg	Pos C ^{8G}	Pos ⁸	Pos C ⁸	Pos C ^{8,9}	Pos ¹⁰	---
15 Proerythroblasts ("Rubriblasts")	Pos M	Pos M	Pos J	Neg	Pos C ⁸	Neg	Neg
16 Early normoblasts ("Pro-rubricytes")	Pos M	Pos M	Pos J	Neg	Pos C ⁸	Neg	Neg
17 Intermediate normoblasts ("Rubricytes")	Pos M	Pos M	---	Neg	Pos C ⁸	Neg	Neg
18 Late normoblasts ("Metarubricytes")	Neg	Neg	---	Neg	Pos C ⁸	Neg	Neg
19 Erythrocytes	Neg	Neg ⁸	Neg ¹⁴	Neg	Neg	Neg	Pos
20 Plasmacytes	---	---	Pos JG	Pos C ⁸	Neg C	Neg ⁷	Neg
21 Reticulum Cells	Pos G	Pos G ⁸	Pos G	---	Neg	Pos G ¹⁵	Neg
22 Mast Cells	Pos G ¹⁶	Pos G	Pos G	Pos G	Neg	Pos G ¹⁷	Pos

/1/ Stained with Sudan black B unless specified otherwise. /2/ Detected by acid-hematein method; negatively evaluated by pyridine extraction method. /3/ Detected by modified Gomori method using glycerophosphate substrate. /4/ Detected by Feulgen reaction; negatively evaluated by digestion with ribonuclease. /5/ Detected by either Periodic Acid-Schiff, or by Gomori silver-methenamine methods. /6/ Detected by benzidine-peroxide. /7/ Controversial. /8/ Diffuse staining. /9/ May be positive (Rabinovitch and Andreucci). /10/ As glycogen. /11/ Trace. /12/ May be positive. /13/ Positive according to Stowell, Wachstein. /14/ Positive when substrate is A.T.P. /15/ Probably is phagocytosed material (Lillie). /16/ Detected by staining with Sudan IV. /17/ Granules positive in many cells, negative in others.

67. BLOOD WATER AND SOLIDS						
Blood (B), RBC (C), Plasma (P), Serum (S)						
Animal		Water g/100 ml ¹		Solids g/100 ml		
		Value	Range	Value	Range	
(A)		(B)	(C)	(D)	(E)	
1	Man	B	83	81-86	23	20-25
2		C	72 ²	70-75 ²	37	34-39
3		P	94 ²	93-95 ²	8.6	7.9-9.1
4		S	93 ³	93-94 ^c		
5	Cat	B	84 ⁴		21 ⁴	
6		C	62 ³		38 ³	
7		S	93 ³		7 ³	
8	Chicken	B	(87) ^{4,5}	(86-89) ^{4,5}		
9		C	72 ⁴	72-74 ⁴		
10		P	94 ⁴	92-95 ⁴		
11	Cow	B	85 ⁴		20 ⁴	
12		C	64 ⁴		44 ⁴	
13		S	91 ³		9 ³	
14	Dog	B	84	83-85	22	20-24
15		C	72	64-80 ^b		
16		P	93	91-95		
17		S	92 ³		7.6 ³	
18	Goat	B	84 ⁴		20.5 ⁴	
19		C	61 ³		39 ³	
20		S	91 ³		9 ³	
21	Horse	B	81 ⁴		24 ⁴	
22		C	61 ³		39 ³	
23		S	91 ³		9 ³	
24	Pig	B	83 ⁴		22 ⁴	
25		C	63 ³		37 ³	
26		S	92 ³		8 ³	
27	Rabbit	B	86 ⁴		19 ⁴	
28		C	70 ⁴		40 ⁴	
29		S	93 ³	92-94 ³	6.7 ³	6.0-7.8 ³
30	Rat	B	86 ⁴	84-87 ⁴	20 ⁴	19-22 ⁴
31		P	95 ⁴		7.8 ⁴	
32	Sheep	B	87 ⁴		19 ⁴	
33		C	67 ⁴		42 ⁴	
34		S	92 ³		8.3 ³	

/1/ Determined by oven-drying methods unless specified otherwise. /2/ 75 (73-76) g/100ml RBC, and 95 (95-96) g/100ml plasma by distillation method. /3/ As grams per 100 grams. /4/ Source data presented in terms of g/100 g; calculated to grams per 100ml by application of values for specific gravity of blood, plasma, or cells. Solids calculated as (100-water content)% by weight, then calculated to g/100ml as above. /5/ Parentheses enclose values calculated on basis of standard hematocrit values and contents in cells and plasma.

68. BLOOD CARBOHYDRATES AND RELATED SUBSTANCES

Blood (B), R B C (C), Plasma (P), Serum (S), Leukocytes (L), Celomic fluid (F)

Constituent	Animal	mg/100ml		Constituent	Animal	mg/100ml	
		Value (C)	Range (D)			Value (C)	Range (D)
1	Man, fasted	B 90	80-200 ^b	30	Opossum	C 81.3 ^a	73-89 ^b .3 ^a
2	Man, fasted	B 86	76-96 ^b	31	Opossum	P 123.3 ^a	107-139 ^b .3 ^a
3	Man	C 74.3 ^a	46-102.3 ^a	32	Ox	C 15.3 ^a	
4	Man	S 97.3 ^a	61-130 ^b .3 ^a	33	Ox	S 85.3 ^a	
5	Man, newborn	B 20-30 ^b .5 ^a	36-116 ^b .7	34	Pig	S 90.3 ^a	
6	Man, fetus	B 48.3 ^a		35	Pig	S 90.3 ^a	
7	Calf	S 118.3 ^a		36	Rabbit	B 85.1 ^a	67-107.5 ^a
8	Calf	B 48		37	Rabbit	C 41.3 ^a	
9	Camel	S 108		38	Rabbit	S 145.3 ^a	
10	Camel	B 74.3 ^a	64-84 ^b .3 ^a	39	Rat, Wistar	B 66.5 ^a .10	56-76 ^b .5 ^a
11	Cat, fasted	B 74.3 ^a		40	Rat, Yale	B 85.3 ^a .10	78-93 ^b .5 ^a
12	Cat	C 76.3 ^a		41	Sheep	B 15.5 ^a .10	18-57.5 ^a
13	Cat	S 297.3 ^a		42	Sheep	C 10.3 ^a	
14	Cattle	B 46.9	36-53.9	43	Sheep	S 80.3 ^a	
15	Dog	B 60.9	44-70.9	44	Sheep, fetus	B 20.2	
16	Dog, fasted	B 77.5 ^a	67-87.5 ^a	45	Chicken	B 170.5 ^a .10	126-204.5 ^a
17	Dog	C 41.3 ^a		46	Duck	B 114.5 ^a	90-138 ^b .5 ^a
18	Dog	S 132.3 ^a		47	Owl	B 152.5 ^a	200-350 ^b .5 ^a
19	Fox	B 104	70-134	48	Pigeon, fasted	B 95.13	117-189 ^b .5 ^a
20	Guinea pig, fasted	B 95.5 ^a .10	60-125 ^b .5 ^a	49	Alligator, fasted	B 63	21-205.3 ^a
21	Guinea pig	B 96.3 ^a .10	83-107 ^b .5 ^a	50	Philodryas	B 67	25-111 ^b
22	Guinea pig	C 53.3 ^a		51	Pit viper, male	B 60	46-88 ^b
23	Guinea pig	S 155.3 ^a		52	Pit viper, female	B 60	22-98 ^b
24	Horse	B 73.9	54-95.9	53	Frog	B 42	36-49 ^b
25	Mink	B 122	72-172 ^b	54	Carp, fresh water	B	
26	Monkey	C 119.3 ^a		55	Eel	B	98-256
27	Monkey	S 148.3 ^a		56	Gastrophilus intestinalis, larva	B	44-141
28	Mouse, fasted	B 109.3 ^a	75-143 ^b .3 ^a				
29	Mouse	B 174.3 ^a	82-266 ^b .3 ^a				

1/ Arterial blood. 2/ Venous blood. 3/ Tungstic acid filtrate. 4/ Fermentation. 5/ Zinc hydroxide filtrate. 6/ Ferrihydride-iodometric titration. 7/ Fermentable sugar in cord blood. 8/ Color formation with ferric ferrocyanide. 9/ "True blood sugar". 10/ Copper-iodometric titration. 11/ Color formation with copper arsenomolybdate. 12/ "Non-fructose, fermentable reducing substance". 13/ Copper molybdate color formation.

2.9. BLOOD CARBOHYDRATES AND RELATED SUBSTANCES (Continued)

Blood (B), RBC (C), Plasma (P), Serum (S), Leukocytes (L), Celomic fluid (F)							
Constituent	Animal	mg/100ml		Constituent	Animal	mg/100ml	
		Value	Range			Value	Range
(A)	(B)	(C)	(D)	(A)	(B)	(C)	(D)
57	Arenicola	P	12	III	Glycogen ^{10,19}	C	0
58	Dasybranchus	F	6	82	Horse	L	3.1
59	Spirunculus	F	2.3-8.7	83	Dog	L	61-78
60	Carcinus	P	7.5-26	84	Man	S	67
61	Carcinus, fasted	P	0	85	Man, aged	S	61
62	Cancer	P	22	86	Man, 3-8 yr	S	70-89
63	Crayfish	P	1-4	87	Man, fetus	S	52-69
64	Bombyx	P	16	88	Man, fetus	S	42-55
65	Hydrophilus	P	6-31	89	Rabbit	S	51-91
66	Mollusc	P	2.1-8.7	90	Man	S	73-131 ²
67	Man	S	7.5-15	91	Man, aged	S	93-126
68	Man, fetus	B	70	92	Polysaccharide ²¹	S	129
69	Sheep, fetus	B	12-126 ¹⁰	93	Man, aged	S	104-138
70	Gastrophilus	B	171 ^{5,17}	94	Man, 3-8 yr	S	105
Fructose	Intestinalis, larva	B	22 ^{5,17}	95	Man, fetus	S	94-118
	pupa, 10-11th day	B	22 ^{5,17}	96	Rat	S	62-103
	Blowfly	B	0.17	97	Rat, fasted	P	2.6-4.8 ²⁵
72	Grasshopper	B	0.17	98	Rabbit, fasted	P	4.4-6.4
73	Waxmoth, larva	B	0.17	99	Rabbit, fasted	P	2.9-7.7
74	Man	B	0-trace	100	Man	P	2.1
75	Woman, pregnant	P	0-trace	101	Rabbit	P	1.5-4.3
Lactose ^{3,13,18}	Woman, lactating,	P	0-2	102	Man	B	6.7 ²⁷
	3-8 days post-	P	1.2-16.2	103	Man	C	4.1-9.3 ²⁷
	partum	P	1.0-3.8	104	Man	P	0.8
77	Man	B	5.5	105	Rat	P	0.9
Glycogen ^{10,19}	Man	L	2.5	106	Rat	C	0.4
	Man	P	0	107	Rabbit	C	1.4
	Man	P	0	108	Rabbit	C	0.3-0
78	Man	P	0	109	Rabbit	C	0.0-1.9

134/ "Fermentable reducing sugar." 15/ Color development with diphenylamine. 16/ Cadmium hydroxide filtrate. 17/ Color development with resorcinol. 18/ Destruction of non-lactose sugar by *B. proteus*. 19/ Cells hemolyzed in water, digested with KOH, precipitation with alcohol, hydrolysis. 20/ Color development with acetylacetone on hydrolysis of alcohol precipitate. 21/ Absorption at 500 m μ by product of tryptophan reaction with acidified alcohol precipitate. 22/ Carbazone reaction with alcohol-precipitated, acid-treated serum. 23/ Trichloroacetic acid filtrate. 23/ Quantitative orcinol reaction. 25, 2, 6 on saline extract of acetone precipitate. 72b/ As glucuronic acid, color development with naphtho-resorcinol, with preliminary hydrolysis but without deproteinization, unless specified otherwise. 727/ conjugate-sulfuric acid filtrate.

66. BLOOD CARBOHYDRATES AND RELATED SUBSTANCES (Continued)

		Blood (B), R B C (C), Plasma (P), Serum (S), Leukocytes (L), Cerebrospinal fluid (F)					
Constituent	Animal	mg/100ml		Constituent	Animal	mg/100ml	
		(A)	(B)			(C)	(D)
107	Man	B	(64)	136	Rat	C	77.3
108	Man	C	136	137	Sheep	B	17.3
109	Man	P	3.9-5.9	138	Sheep	C	45.3
110	Chicken	C	1156	139	Chicken	B	27.3
111	Duck	C	1530	140	Chicken	C	57.4
112	Goose	C	1360	141	Duck	C	120.3
113	Man	P	0.8	142	Pigeon	C	182.3
114	Man	C	Trace	143	Turtle, sea	B	37.3
115	Man	L	6.84/1 million	144	Turtle, snapping	B	96.3
116	Chicken	C	1060	145	Alligator	C	47.3
117	Duck	C	2590	146	Frog	B	14.4
118	Goose	C	3760	147	Frog	P	23.54
119	Man	B	44.30	148	Snake	C	562.3
120	Man, male	B	46.3	149	Snake	P	0.4
121	Man, female	B	39.3	150	Catfish	C	167.3
122	Man	B	72.2	151	Chicken	B	0.4
123	Guinea pig	C	28.30	152	Frog	B	0.4
124	Guinea pig	C	56.3	153	Chicken	B	0.4
125	Cat	C	14.30	154	Frog	B	0.4
126	Cat	C	52.3	155	Man	B	3.6
127	Cattle	C	27.3	156	Man	C	7.7
128	Dog	C	19.30	157	Man	P	0.012
129	Dog	C	52.3	158	Man	C	0.075
130	Horse	C	18.3	159	Man	C	0.069-0.081
131	Pig	C	65.30	160	Man	C	120
132	Pig	C	115.3	161	Cat	C	17
133	Rabbit	B	54.30	162	Dog	C	133
134	Rabbit	C	112.3	163	Horse	C	140
135	Rat	B	38.30	164	Pig	C	190
					Rabbit	C	194

28/ Alkali-treatment, precipitation with trichloroacetic acid; determination of phosphorus fractions. /30/ Trichloroacetic acid filtrate, determination of "7" minutes hydrolysable phosphorus" and determination of phosphorus fractions. /31/ Trichloroacetic acid filtrate, determination of "7" minutes hydrolysable phosphorus" and determination of phosphorus fractions. /32/ Trichloroacetic acid filtrate, determination of inorganic phosphorus liberated by sulfuric acid in 8 minutes. /33/ 8 minutes phosphorus; also see /28/. /34/ Perchloric acid filtrate; measurement of inosinic acid in spectrophotometer after conversion by hexokinase, myokinase and aldolase. /35/ Formation of fluorescent product with alkali-acetone. /36/ Flavin Adenine Dinucleotide; assay by oxygen uptake of di-alanine in presence of excess d-amino acid oxidase.

68. BLOOD CARBOHYDRATES AND RELATED SUBSTANCES (Concluded)

Blood (B), R B C (C), Plasma (P), Serum (S), Leukocytes (L), Cerebro fluid (F)		mg/100ml		Constituent	Animal	mg/100ml		Constituent	Animal	mg/100ml	
Constituent	(A)	Value	Range			Value	Range			Value	Range
(a)	(B)	(C)	(D)	(A)	(B)	(C)	(D)	(A)	(B)	(C)	(D)
165 Rat	P	146		189	Man	B	1.3		Man	B	0.0-3.1
166 Sheep	C	<3.5		190	Man, infant	B	0.8		Man, infant	B	0.6-1.0
167 Birds	C	0		191	Dog	B	1.0		Dog	B	0.7-1.3
168 Reptiles	C	0		192	Rabbit	B	1.1		Rabbit	B	
169 Fish	C	0		193	Rat	B	0.9		Rat	B	
170 Mammals	C	0		194	Pigeon	B	0.241		Pigeon	B	
171 Chicken	C	251		195	Man	B	0.241		Man	B	
172 Duck	C	264		196	Man, adult	S	2.45		Man, adult	S	1.6-3.2545
173 Pigeon	C	285		197	Man, child	S	2.85		Man, child	S	1.8-3.8545
174 Turtle	C	95		198	Man, newborn	S			Man, newborn	S	3-645
175 Man	B	249		199	Man	B	1.945		Man	B	1.3-2.545
176 Man	C	129		200	Man	P	2.45		Man	P	1.4-3.0545
177 Man	P	369		201	Man	P	0.547		Man	P	0.1-0.9547
178 Man	B	1940		202	Man	B	<0.345		Man	B	
179 Dog	B	1939	0-4140	203	Man	P	0.5		Man	P	
180 Dog	C	22.59	7-2939	204	Man	P			Man	P	
181 Rat	B	1339	8.5-3739	205	Man	P			Man	P	
182 Sheep	B	2139	5-2139								
183 Carp	B	1639	13-1639								
184 Man	B	0.341									
185 Man	P	1.242									
186 Guinea pig	P	2.3	0.4-2.0542								
187 Rabbit	P	1.942									
188 Rat	B	1.942									

/37/ Color formation with naphtho-resorcinol after precipitation by lead acetate. /38/ Precipitation as calcium salt, determination of phosphorus. /39/ Tungstic acid filtrate, oxidation by Mn++ to acetaldehyde and titration of bound bisulfite with iodine. /40/ Conversion to acetaldehyde by concentrated sulfuric acid, color formation with para-hydroxy diphenyl; cutaneous blood from finger tip. /41/ Separation of dinitrophenylhydrazones by chromatography prior to color formation with sodium carbonate. /42/ Color formation with sodium carbonate. /43/ Formation and extraction of dinitro-phenylhydrazones; color formation with sodium carbonate. /44/ Oxidation to succinic acid, manometric measurement with succinic dehydrogenase. /45/ Formation of penta-bromo-acetone, color formation with sodium sulfide. /46/ Measurement of bromine in penta-bromo-acetone by reaction of bromate with iodine. /47/ Formation of fluorescent compound with orcinol. /48/ Chromatographic separation in column of silica gel, titration with alkali. /49/ See table on Blood Vitamin Content.

69. BLOOD LIPIDS

Blood (B), RBC (C), Plasma (P), Serum (S)

Blood (B), RBC (C), Plasma (P), Serum (S)

Constituent		Animal	Lipids mg/100 ml		Constituent	Animal	Lipids mg/100 ml		
(A)			Value	Range			Value	Range	
(A)	(B)	(C)	(D)	(A)	(B)	(C)	(D)		
1	Lipids, total ^{1,2}	Man	B (559) ³	(397-722) ³	32	Phospholipid ²	Rabbit	B (145) ³	(93-204) ³
2		Man	C 596	411-781 ^b	33		Rabbit	C 240	191-289 ^b
3		Man	P 530	385-675 ^b	34		Rabbit	P 78	13-143 ^b
4		Cat	P 376	145-607 ^b	35		Rat	P 83	36-130 ^b
5		Chicken	P 520	341-699 ^b	36		Sheep	P 90	24-123 ^b
6		Cow	P 348	185-511 ^b	37	Lecithin	Man	B (115) ³	50-204
7		Dog	P 580	47-725 ^d	38		Man	C (70) ⁶	
8		Goat	P 300		39		Man	P 117 ⁵	
9		Guinea pig	P 169	96-246 ^b	40		Man	S 107	300-470 ^d
10	Rabbit	P 243	69-417 ^b	41	Cow		S 54		
11	Rat	P 230	69-417 ^b	42	Dog	P 370			
12	Neutral fat ²	Man	B 134	85-237 ^b	43	Dog	S 288		
13		Man	C 93	11-148 ^b	44	Pig	S 72		
14		Man	P 142	24-260 ^b	45	Rabbit	C 85	56-116 ^b	
15		Cat	P 108	0-245 ^b	46	Cephalin	Man	B 65	31-118
16		Chicken	P 225	63-387 ^b	47		Man	C (210) ⁶	
17		Cow	P 105	0-230 ^b	48		Man	P 7 ⁵	
18		Guinea pig	P 73	0-146 ^b	49		Cow	S 3	64-150 ^b
19		Rabbit	B (78) ³	(4-155) ³	50		Dog	P 22	
20		Rabbit	C 41	0-86 ^b	51		Pig	S 3	
21	Rabbit	P 105	7-203 ^b	52	Rabbit		B (60) ³		
22	Rat	P 85	26-144 ^b	53	Rabbit		C 107		
23	Phospholipid ²	Man	B (247) ³	(186-309) ³	54		Rabbit	P 27	
24		Man	C 350 ⁴	280-420 ^{4b}	55	Sphingomyelin	Man	B 186	35-59 ^b
25		Man	P 165	110-220 ^b	56		Man	C (70) ⁶	
26		Cat	P 132	21-243 ^b	57		Man	P 41 ⁵	
27		Chicken	P 155	84-226 ^b	58		Cow	S 22	
28		Cow	P 84	17-151 ^b	59		Dog	S 55	
29		Cow	S 80		60		Pig	S 21	
30		Guinea pig	P 51	25-77 ^b	61		Rabbit	B (42) ³	
31		Pig	P 96	80-130 ^d	62		Rabbit	C 47	
	Cholesterol ²	Man	B		63		Rabbit	P 38	
		Man	C	173	129-228	64	Man	B	
	Man	P	152	118-228	65	Man	C		
				105-199 ^b	66				

(Continued on the next page)

/1/ Total lipids = Cholesteryl esters + Free Cholesterol + Phospholipid + Neutral Fat. /2/ Determined by oxidimetric methods on oxalated blood of fasted animals, unless specified otherwise. /3/ Parentheses () enclose values calculated on basis of hematocrit and content of constituent in blood, cells or plasma. /4/ Phospholipid P (determined by method of Blomquist and ...). /5/ Phospholipid P (determined by ...). /6/ Values calculated on basis of following probable approximate partition of total phospholipid in human red blood cells: cephalin, 60%, lecithin, 20%, sphingomyelin 20%.

69. BLOOD LIPIDS (Concluded)

69. BLOOD LIPIDS (Concluded)

Constituent

Blood (B), RBC (C), Plasma (P), Serum (S)

(A)

Animal

Lipids
mg/100 ml

Value

Range

Constituent

Animal

Lipids
mg/100 ml

Value

Range

Cholesterol²

(B)

(C)

(D)

(A)

(B)

(C)

(D)

Cholesterol,
esterified

Cholesteryl
esters⁷

Cholesterol,
free

Fatty acids, 2
total

/7/ Cholesteryl esters = 1 69 x esterified cholesterol
modification

/8/ Determined by Sperry-Schoenheimer method, or
from neutral fats = 0.95 x neutral fats
from phospholipids = 0.65 x Phospholipids
from cholesteryl esters = 0.43 x cholesteryl esters

^{7/} Cholesteryl esters = 1.69 x esterified cholesterol modification

^{8/} Determined by Sperry-Schoenheimer method, or from neutral fats = 0.95 x neutral fats from phospholipids = 0.65 x Phospholipids from cholesteryl esters = 0.43 x cholesteryl esters

70. BLOOD PROTEINS: MAN

Constituent	Blood		Erythrocytes		Plasma ¹	
	Value	Range	Value	Range	Value	Range
	g/100ml (B)	g/100ml (C)	g/100ml (D)	g/100ml (E)	g/100ml (F)	g/100ml (G)
1 Protein, total	20.5		36.8		7.41	
2 Hemoglobin	14.9 ²		33.5 ³	30-40 ^b	trace	0.001-0.005
3 Corpuscle stroma	1.5 ³		3.3			
4 Plasma protein	4.1 ³		—	—	7.41	
5 Fibrinogen	0.16 ³		—	—	0.28	0.23-0.36 ^d
6 Serum protein	3.9 ³		—	—	7.13	6.4-7.9 ^b

/1/ Salt fractionation methods. /2/ Average of male, value = 15.8 (range = 14-18^b) and female, value = 13.9 (range = 11.5-16^b). /3/ Calculated on the basis of hematocrit value of 44.5% (see Table 37).

71. PLASMA PROTEINS: MAN

Constituent	Salt Fractionation Method ¹			Salt Fractionation Method ²			Electrophoretic Method			Electrophoretic Meth. (Corrected) ³		
	Value		Range	Value		Range	Value		Range	Value		Value
	(B)	(C)		(E)	(F)		(H)	(I)		(K)	(L)	
(A)												
1 Plasma protein, total	100	7.48		100	7.41		100	7.30		100	6.56	
2 Fibrinogen	3.7	0.28 ⁴	0.23-0.36 ⁴	3.8	0.28 ⁴	0.23-0.36 ⁴	4.0	0.29		4.7	0.31	
3 Serum protein, total	96.3	7.2	6.5-7.9	96.2	7.13	6.4-7.9 ^b	96.0	7.01	6.3-7.7 ^b	95.3	6.27	
4 Albumin	59.5	5.2	4.7-5.7	61.8	4.58	4.1-5.1 ^b	60.5	4.42	4.0-4.8 ^b	50.1	3.30	
5 Globulin, total	26.8	2.0	1.3-2.5	34.4	2.55	1.8-3.3 ^b	35.5	2.59		45.2	2.97	
6 Alpha ₁ -globulin							4.0	0.29	0.2-0.4 ^b			
7 Alpha ₂ -globulin							7.7	0.56	0.4-0.7 ^b	14.0		
8 Beta-globulin							11.5	0.84	0.6-1.1 ^b	19.3	1.27	
9 Gamma-globulin							12.3	0.90	0.6-1.2 ^b	11.9	0.78	
10 Euglobulin	2.7	0.2	-0.4	21.4	1.59	0.9-2.2 ^b						
11 Pseudoglobulin, total	29.1	1.8		13.0	0.96	0.6-1.35 ^b						
12 Pseudoglobulin I	17.4	1.3	0.8-1.9									
13 Pseudoglobulin II	6.7	0.5	0.2-0.9									
14 Albumin/globulin ratio		2.6		1.8				1.71	1.3-2.2 ^b		1.1	

/1/ Method of Howe, P.E., 1921. /2/ Micro-Major method, 1947 /3/ Corrected for nitrogen factor, refractive increment differences, ionic strength, total protein concentration effects. Red Cross pooled plasma used, corrected for dilution with citrate. /4/ Value not from Milnes-Major or Howe. See bibliography.

72. PLASMA PROTEINS¹: ANIMALS OTHER THAN MAN

Animal	Plasma Protein Total		Fibrinogen		Serum Protein Total		Albumin		Globulin	
	g/100ml		g/100ml		g/100ml		g/100ml		g/100ml	
	Value (H)	Range (C)	Value (D)	Range (E)	Value (F)	Range (G)	Value (H)	Range (I)	Value (J)	Range (K)
1 Cat					7.58	6.1-9.0 ^b	4.01	3.5-4.6 ^b	3.57	2.1-5.0 ^b
2 Chicken	8.32	7.4-10.2	0.72		3.60	2.6-4.6	1.82		1.78	
3 Cow	6.72	6.1-7.8	0.52	0.42-0.64	7.60 ²		3.63 ^{2,3}		3.97 ^{2,3}	
4 Dog	7.27		0.50		6.20 ²	4.9-7.9	3.57 ^{2,4}	3.1-4.0	2.63 ^{2,4}	2.0-3.3
5 Goat	4.70		0.33		6.67 ²		3.96 ^{2,5}		2.71 ^{2,5}	
6 Guinea pig	4.70		0.34		4.37		3.03		1.36	
7 Horse	6.84		0.32	0.29-0.43	6.50 ²		3.25 ^{2,6}		3.25 ^{2,6}	
8 Monkey	5.82			0.25-0.40	5.50	5.84-6.20 ^b	4.50		4.52	
9 Mouse					6.02		4.20 ^{2,7}		1.50 ^{2,7}	
10 Rabbit					5.70 ²		3.86	3.4-4.3 ^b	2.18	1.8-2.5 ^b
11 Rat	6.29		0.25	0.16-0.34 ^b	6.04	5.5-6.5 ^b	3.07		2.31	
12 Sheep	5.74		0.36		5.38		2.03		3.27	
13 Swine					6.30					

^{1/1} The data represent chemical methods (salting-out, colorimetric, etc.); in most instances 6.25 used as Nitrogen factor in calculating protein. "Fraction V," precipitated with the albumin in the Howe salting-out method, should be subtracted from the albumin and added to the globulin to permit comparison with results of later methods. ^{2/2} Total serum protein partitioned into albumin and globulin by means of average of measured A/G ratios. ^{3/3} A/G = 0.92. ^{4/4} A/G = 1.36. ^{5/5} A/G = 1.46. ^{6/6} A/G = 1.0. ^{7/7} A/G = 2.80.

73. PLASMA PROTEINS, CERTAIN PROPERTIES AND REACTIONS: MAN

Classification	Purified Protein Component	Electrophoretic Fraction	Interacts with	General Properties
(A)	(B)	(C)	(D)	(E)
1 Blood coagulation agents	Antithrombotic globulin		Thrombin	Clots hemophilic blood
2	Fibrinogen		Proteins	Forms fibrin clot
3	Plasmin		Streptokinase	Dissolves plasma clot
4	Plasminogen		Thromboplastin	Enzyme precursor
5	Prothrombin		Fibrinogen	Enzyme precursor
6	Thrombin			Catalyzes formation of fibrin clot
7	Antibody gamma-			Antibodies for pathogenic organisms
8	Diphtheria antitoxin	Gamma-globulin	Antigens	
9	Antibody euglobulin	Gamma-globulin	Diphtheria toxin	
10	Isogglutinin	Beta- & gamma-globulin	Antigens	Contain typhoid "O" agglutinins
11	Complement components C ₁ , C ₂	Beta- & gamma-globulin	Antigens of incompatible red blood cells	Anti-A, anti-B, & anti-RH agglutinins
12	Choline esterase	Alpha- & beta-globulin	Antigen-antibody complex	
13	Peptidase		Choline esters	
14	Phosphatase alkaline		1-Leucylglycylglycine	
15	Plasmin (see 3A-E)		Phosphoric acid monoesters	
16	Thrombin (see 6A-E)			
17	Iodoglobulin	Alpha-globulin		
18	Thyrotrophic hormone	Alpha-globulin		Thyroid-active protein
19	Albumin	Albumin	Fatty acids, bile salts, dyes, & drugs	Influences thyroid activity
20	Mercaptalbumin	Albumin	Mercury	Osmotic regulation of blood volume
21	Alpha ₁ -lipoprotein	Alpha ₁ -globulin	Steroids	Have sulfhydryl groups
22	Alpha ₁ -bilirubin globulin	Alpha ₁ -globulin	Bilirubin	35% lipid
23	Alpha ₂ -glycoproteins	Alpha ₂ -globulin	Carbohydrates & barium	
24	Alpha ₂ -mucoproteins	Alpha ₂ -globulin	Carbohydrates & barium	
25	Beta ₁ -lipoproteins	Beta ₁ -globulin	Estrol, carotenoids, & other steroids	75% lipid, carrier for vitamins & hormones
26	Beta ₁ -metal-combining protein ¹		Iron & Copper	Binds 2 Fe ⁺⁺⁺ or Cu ⁺⁺ per molecule ²
27	Beta ₁ -lipid-poor euglobulins			
28	Ceruloplasmin		Copper	

¹/ Other enzymes include acid phosphatase, amylase, tributyrin esterase, beta-glucuronidase
²/ Binds iron much more strongly than copper

²/ = Siderophilin, trans-

74. PLASMA PROTEINS, PHYSICAL PROPERTIES: MAN

Purified Component	Concentra- tion in Fraction	Estimated Amount g/100 g Plasma Protein	Approx. Iso- electric Point pH	Molecular Weight M	Sedimen- tation Constant S _{20,w}	Specific Volume V	Intrin- sic Vis- cosity η_{sp}/c , 10 ⁻²	Frictional Ratio f/f_0	Approx. Dimensions Angstrom Units	
									Length	Diameter
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)
1 Antihemophilic globulin	I	0.15	<5.3							
2 Cold-insoluble globulin ¹	I-1	4	<5.3	400,000	9		25	1.98	700	38
3 Fibrinogen	I-2		6.3	156,000	7	0.739	6	1.38	235	44
4 Gamma-globulins	II	11 { 9	7.3	300,000	10	0.739				
5 Diphtheria antitoxin	II	0.001								
6 Beta ₁ -lipoprotein	III-0	5	5.4	1,300,000	7	0.950	4.1		185	185
7 Beta ₁ -lipid-poor euglobulins	III-0	3 { 2	5.5		7					
8 Cereuloplasmin	III-0	1 { 1	5.5		20					
9 IgG globulins	III-1		4.4							
10 Antibody euglobulins	III-1		4.4							
11 Prothrombin	III-2	0.03	6.3							
12 Complement components, C'1, C'2	III-2&IV	0.1								
13 Plasminogen	III-3	0.4								
14 Plasmin	III-3									
15 Beta ₂ -globulins	IV-1	3	6.3							
16 Alpha ₁ -lipoprotein	IV-1	3	5.2	200,000	5	0.841	6.6	1.38	300	50
17 Thyrotrophic hormone	IV-4									
18 Alpha ₂ -glycoprotein	IV-6	1.2	4.9		9					
19 Alpha ₂ -mucoprotein	IV-6	0.5	4.9		9					
20 Cholinesterase	IV-6	0.005	4.5		9					
21 Peptidase	IV									
22 Phosphatase, alkaline	IV									
23 Iodoglobulin	IV-6									
24 Beta ₁ -metal combining protein	IV-7	3	5.8	90,000	5	0.725	5.5	1.37	190	37
25 Albumin, serum	V	52	4.9	69,000	4.6	0.733	4.2	1.28	150	38
26 Mercaptalbumin	V	34								
27 Alpha ₁ -bilirubin globulin	V-1	0.05	4.7							
28 Alpha ₂ -protein	VI-1	0.1								
29 Beta ₁ -protein	VI-1	0.05								
30 Alpha ₁ -small acid protein ²	VI-2	0.5	3.0		2.9					
31					5					
32					3.5					

/1/ Non-clottable protein, insoluble at low temperature. /2/ Acid glycoprotein.

75. BLOOD FREE AMINO ACIDS¹

Constituent	Animal	100 ml Blood mg		100 ml RBC mg		100 ml Plasma ² mg	
		Value	Range	Value	Range	Value	Range
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)
1 Alanine	Man	4.0	2.8-5.2 ^b	4.0	2.5-5.6 ^b	4.0 ³	2.6-5.3 ^b
2	Mouse					5.9	5.3-6.6
3	Rat	12.3	9.0-15.6 ^b				
4 Arginine	Man	1.0	0.6-1.7 ^b	0.3	0.1-0.6 ^b	2.3	1.1-3.5 ^b
5	Dog	3.7	1.7-5.2	4.2		3.3 ³	1.8-4.8 ^{b,4}
6	Mouse					0.97	0.9-1.0
7	Rat					3.9	2.7-4.9 ^{b,5}
8 Aspartic acid	Man						0.9-1.2
9 Citrulline ⁶	Man						0.3-1.0
10	Dog						0.8-1.5
11 Cysteine	Horse	0.3		0.5		0.2	
12	Man	0.9	0.6-1.2 ^b	0.4	0.3-0.5 ^b	1.4	0.8-2.0 ^b
13	Dog					0.9	0.5-1.5
14	Horse					1.6	
15	Pig						0.6-0.9
16	Rabbit						0.9-1.1
17	Rat						0.7-0.9
18 Glutamic acid	Man					0.8 ^{7,8}	0.6-1.7 ⁷
19	Cat					2.1	
20	Dog					<0.6	
21	Mouse					3.3	2.9-3.6
22	Man		1.8-2.5	2.4	1.6-3.1 ^b	1.8	1.3-2.3
23	Guinea pig					2.5	
24	Mouse					1.9	1.7-2.3
25	Rabbit					4.0	
26	Rat					3.1	1.5-4.6 ^{b,5}
27	Man	1.3	0.9-1.7	1.1	0.8-1.6	1.4	1.1-1.8 ^b
28	Dog	1.3	1.0-2.0			1.2	0.9-1.6 ^b
29	Mouse					1.6	1.4-1.7
30	Rat					1.2	0.9-1.5 ^{b,5}
31	Man	1.3	0.9-1.5	0.9	0.5-1.4	1.6	1.0-2.2 ^b
32	Dog	1.8	1.2-2.2 ^b			1.3	0.5-2.1 ^b
33	Mouse					1.5	1.2-2.0 ^b
34	Rat					1.4	0.7-2.5 ^{b,5}
35	Man	1.7	1.4-2.0 ^b	1.5	1.0-1.8 ^b	1.9	1.3-2.5 ^b
36	Dog	2.5	1.2-3.6			2.1	1.6-2.8
37	Mouse					2.4	2.2-2.8
38	Rat					2.1	1.1-3.7 ^{b,5}
39	Man	2.2	1.3-3.0 ^b	1.4	0.9-1.8 ^b	3.0	2.1-3.0 ^b
40	Dog	2.5	1.6-3.6			2.4	1.3-3.6 ^b
41	Goat					1.8	1.3-2.4
42	Mouse					6.4	5.7-7.0
43	Rat					7.2	4.0-10.4 ^{b,5}
44	Man	0.8	0.4-0.6 ^b	0.5	0.3-0.8 ^b	0.5	0.3-0.6 ^b
45	Dog	1.2	0.8-1.7				0.2-1.9
46	Mouse					1.9	1.7-2.2
47	Rat					1.0	0.6-1.3 ^{b,5}

Note See footnotes on next page

(Continued on the next page)

75. BLOOD FREE AMINO ACIDS¹ (Concluded)

Constituent	Animal	100 ml Blood mg		100 ml R B C mg		100 ml Plasma ² mg		
		Value	Range	Value	Range	Value	Range	
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	
48	Phenylalanine	Man	1.0	0.8-1.2 ^b	1.0	0.7-1.3 ^b	1.4	0.5-2.2 ^b
49		Dog	1.5	0.9-2.5			1.2	
50		Mouse					2.4	2.0-3.2
51		Rat					1.1	0.7-1.5 ^{b,5}
52	Proline	Man						2.4-2.7
53		Mouse					1.8	1.6-2.1
54		Rat				3.6	3.3-3.9 ^{b,5}	
55	Threonine	Man	1.6	1.3-2.0 ^b	1.6	1.3-2.1 ^b	2.0	1.1-2.6 ^b
56		Dog	2.4	1.2-3.3			2.6	1.2-4.0 ^b
57		Mouse					3.5	3.0-3.9
58		Rat					4.2	2.3-6.2 ^{b,5}
59	Tryptophan	Man	0.7	0.5-1.0 ^b	0.24	0.2-0.4 ^b	1.1	0.7-1.5 ^b
60		Cow					1.1	0.8-1.2
61		Dog	1.2	0.6-2.4			1.2	0.8-1.5
62		Horse					1.2	
63		Mouse					2.1	1.5-2.6
64		Pig					1.1	1.0-1.2
65		Rat	1.6	1.5-2.0			1.5	0.8-2.1 ^{b,5}
66		Sheep				1.1	0.8-1.5 ^b	
67	Tyrosine	Man	1.1	0.8-1.4 ^b	1.1	0.7-1.5 ^b	1.5	0.8-2.2 ^b
68		Dog	1.2	0.7-2.0			1.1	0.6-1.5 ^b
69		Goat					1.2	1.0-1.5
70		Mouse					2.5	2.4-2.7
71		Rat					1.5	0.8-2.2 ^{b,5}
72	Valine	Man	2.4	2.0-2.9 ^b	2.0	1.6-2.5 ^b	2.8	2.2-3.5 ^b
73		Dog	2.6	1.5-4.1			2.2	1.2-3.3 ^b
74		Mouse					4.3	3.8-5.0
75		Rat					2.6	1.5-3.6 ^{b,5}

for glutamine. ¹ include microbiologically /3/ 0.07 mg in beta diacetyl method. /7/ method, corrected

76. BLOOD NON-PROTEIN NITROGEN COMPOUNDS

Blood (B), R B C (C), Plasma (P), Serum (S).

Constituent	Animal	Non-Protein N Compounds per 100 ml		Constituent	Animal	Non-Protein N Compounds per 100 ml	
		Value mg	Range mg			Value mg	Range mg
(A)	(B)	(C)	(D)	(A)	(B)	(C)	(D)
1 Amino Acids ¹	Man	B 50	38-53	19 Nucleotides	Man	B 41	31-52
2 Ammonia	Man	B 0.18	0.12-0.24	20 Polypeptides	Man	B <7	
3 Bilirubin	Man	B 0.18	0.1-0.25	21	Man	B 32	24-40 ^b
4	Man	B 3.9	2.9-4.9 ^b	22	Man	C 30	25-39 ^b
5 Creatine	Man	C 8.1	6.0-10.2 ^b	23	Man	P 34	28-40 ^b
6	Man	P 0.23	0.0-0.8 ^b	24 Urea	Man ♂	B 33	26-46
7	Chicken	B 2.1		25	Man ♂	P 27	19-36
8	Man	B 1.5	1.0-2.0	26	Man ♀	B 24	11-29
9 Creatinine	Man	C 1.8	1.7-1.9 ^b	27	Rat	P 34	
10	Man	P 0.91	0.87-0.95 ^b	28	Chicken	B 5.7	
11 Ergothioneine ²	Man			29	Man	B 3.2	2.2-4.2 ^b
12	Dog	C	5.0-12.0	30	Man	C 1.9	0.8-3.0 ^b
13 Glutamine	Dog	P	3.8-7.2	31	Man	P 3.8	2.0-5.6 ^b
14	Horse	C 7.2	7-13	32 Uric Acid	Man ♂	S 4.8	
15				33	Man ♀	S 4.0	
16 Glutathione ²				34	Dog	P 0.33	
17 Lecithin ³				35	Rat	B 1.5	0.5-3.4
18 Methyl guanidine	Man	B 0.25	0.2-0.3	36	Chicken	B 4.5	
				37	Vitamins ⁴		

/1/ For details see table on Blood Free Amino Acid Content. /2/ See table on Blood Sulfur Compounds. /3/ See table on Blood Lipid Content. /4/ See table on Blood Vitamin Content.

77. NITROGEN CONTENT OF BLOOD NITROGEN COMPOUNDS

Compound		g Nitrogen in 1 g Compound	Compound		g Nitrogen in 1 g Compound
(A)		(B)	(A)		(B)
1	Alanine	0.1572	28	Leucine	0.1068
2	Amino-butyric acid	0.1358	29	Lysine	0.1916
3	Ammonia	0.8275	30	Methionine	0.0939
4	Arginine	0.3216	31	Nicotinamide	0.2294
5	Asparagine	0.2120	32	Nicotinic acid	0.1138
6	Aspartic acid	0.1052	33	Norleucine	0.1068
7	Bilirubin	0.0978	34	Norvaline	0.1196
8	Biliverdin	0.0927	35	Ornithine	0.2120
9	Biotin	0.1147	36	Pantothenic acid	0.0639
10	Choline	0.1156	37	Para-aminobenzoic acid	0.1022
11	Citrulline	0.2499	38	Phenylalanine	0.0848
12	Creatine	0.3205	39	Proline	0.1217
13	Creatinine	0.3715	40	Proteins	0.1600
14	Cysteine	0.1156	41	Pyridoxin	0.0828
15	Cystine	0.1166	42	Pteroylglutamic acid	0.2278
16	Epinephrin	0.7646	43	Riboflavin	0.1489
17	Ergothionine	0.1849	44	Serine	0.1333
18	Glucosamine	0.0782	45	Thiamin	0.1661
19	Glutamic acid	0.0952	46	Threonine	0.1176
20	Glutamine	0.1917	47	Thyroxin	0.0180
21	Glutathione	0.1367	48	Tryptophan	0.1372
22	Glycine	0.1866	49	Tyrosine	0.1725
23	Histamine	0.3781	50	Urea	0.4665
24	Histidine	0.2708	51	Uric acid	0.3333
25	Hydroxyproline	0.1068	52	Valine	0.1196
26	Indican	0.0401			
27	Isoleucine	0.1068			

78. BLOOD PHOSPHORUS, INORGANIC

Animal		Blood (B); R B C (C); Plasma (P); Serum (S)			Phosphorus mg/100 ml		
		Phosphorus mg/100 ml		Animal	Phosphorus mg/100 ml		
		Value (B)	Range (C)		Value (B)	Range (C)	
1	Man	B 2.92	2.1-3.82	21	Rat	B 5.63	
2		C 2.42	0.91-3.32	22		C 4.5	3.3-5.83
3		P 3.22	2.4-4.42	23		P 7.7	6.0-9.03
4	Camel	B 5.63		24	Sheep	B 6.4	5.7-7.14
5	Cat	B 5.64	4.6-6.94	25	Canary	B 5.63	
6	Dog	B 3.1	2.1-4.0	26	Chicken	B 3.5	
7		P 3.43	3.2-6.05	27	Duck	B 5.4	
8	Elephant	B 5.74	4.0-6.14	28	Goose	B 5.4	
9	Goat	B 4.4	2.6-5.74	29	Pigeon	B 5.4	
10	Guinea Pig	B 2.34	2.0-2.54	30	Turkey	B 5.4	
11	Horse	B 4.33		31	Alligator	B 5.63	
12	Kangaroo	B 3.64		32	Snake	B 2.93	
13	Monkey	B 7.43		33	Snake, moccasin	B 7.03	
14	Mouse	B 5.84	4.9-7.24	34	Snake, water	B 7.03	
15	Opossum	B 8.04	7.2-8.54	35	Turtle, snapping	B 3.33	
16	Ox	B 3.34	2.7-3.84	36	Frog, bull	B 5.13	
17	Pig	P 5.06	3.4-6.96	37	Frog, green	B 8.13	
18	Rabbit	B 4.33		38	Necturus	B 5.33	
19				39	Bass, black	B 17.13	
20	Raccoon			40	Catfish	B 7.83	
					Eel, congo	B 5.63	

/1/ Sample range "c" except as noted. /2/ Oxalated blood; determined by Fiske-Subbarow method. /3/ Heparinized blood; determined by Fiske-Subbarow method. /4/ Oxalated blood; Byrom and Kay partition. /5/ Determined by Gomori method. /6/ Oxalated blood; determined by Kuttner and Lichtenstein method.

79. BLOOD PHOSPHORUS, ORGANIC ACID-SOLUBLE¹

Blood (B); R B C (C)

Animal		Phosphorus mg/100 ml		Animal		Phosphorus mg/100 ml	
		Value	Range			Value	Range
(A)		(B)	(C)	(A)		(B)	(C)
1	Man	B 23.1 ²	18.6-29 ²	31	Raccoon	B (22.2) ⁴	
2		C 50 ²	39 -59 ²	32		C 62 ⁴	
3	Camel	B 15.3 ³		33	Rat	B (23.0) ³	
4		C 63 ³		34		C 50 ³	
5	Cat	B (8.3) ³	(7.7-9.1) ³	35	Sheep	B (4.5) ³	
6		C 20.7 ³	19.2-22.7 ³	36		C 14.0 ³	
7	Dog	B (26) ³		37	Canary	B (61) ⁴	
8		C 57 ³		38		C 131 ⁴	
9	Elephant	B (15.4) ⁴		39	Chicken	B (30) ⁴	
10		C 48 ⁴		40		C 91 ⁴	
11	Goat	B 3.5 ³		41	Duck	B 38 ³	
12		C 12.1 ³		42		C 111 ³	
13	Guinea pig	B (27) ³		43	Goose	B (44) ³	
14		C 65 ³		44		C 101 ³	
15	Horse	B (16.3) ³		45	Pigeon	B (52) ³	
16		C 47 ³		46		C 120 ³	
17	Kangaroo	B (27) ⁴		47	Turkey	B (45) ³	
18		C 53 ⁴		48		C 94 ³	
19	Monkey	B (21.5) ⁴		49	Alligator	B (2.4) ⁴	
20		C 51 ⁴		50		C 13.9 ⁴	
21	Mouse	B (34) ⁴		51	Snake, moccasin	B (33) ⁴	
22		C 85 ⁴		52		C 165 ⁴	
23	Opossum	B (21.8) ⁴		53	Turtle, snapping	B (14.1) ⁴	
24		C 51 ⁴		54		C 59 ⁴	
25	Ox	B (3.6) ³		55	Frog, bull	B (13.2) ⁴	
26		C 9.1 ³		56		C 44 ⁴	
27	Pig	B (40) ³		57	Necturus	B (18.2) ⁴	
28		C 97 ³		58		C 97 ⁴	
29	Rabbit	B 37 ³		59	Catfish	B (21.4) ⁴	
30		C 88 ³		60		C 57 ⁴	

/1/ All determinations on whole blood; cell content calculated on basis of blood content of the constituent and the standard hematocrit values. Calculated values are in parentheses (). In each of the following groups of figures the first number is the item number in the table, followed by the standard hematocrit value (underscored) and/or the hematocrit value reported by the investigator: (1), 44.5, (3), 24.3; (5), 40, 28.4; (7), 45.5, 34.1; (9), 32.2; (11), 34.5, 28.8; (13) 42.0, 36.4; (15), 35, 41; (17), 49.9; (19), 42, 43; (21), 41.5, 39.8; (23), 42.9; (25), 40, 38.8; (27), 41.5, 41.6, (29), 41.5, 41.6, (31), 36.1, (33), 46.0, 48.8; (35), 32, 31; (37), 46.5; (39), 32, 33.5, (41), 39.5, 44.5; (43), 44, 41; (45), 42.5, 45.1; (47), 38, 40, (49), 17.1, (51), 20.2, (53), 24.1; (55), 30, 30.8; (57), 18.8, (59), 34.6. /2/ Oxalated blood, determined by Lohmann method. /3/ Defibrinated blood, determined by Fiske-Subbarow method. /4/ Heparinized blood; determined by Fiske-Subbarow method.

80. BLOOD ADENOSINE TRIPHOSPHATE PHOSPHORUS¹

Animal		Phosphorus mg/100 ml		Blood (B); R B C (C)		
		Value	Range	Animal	Phosphorus mg/100 ml	
(A)	(B)	(C)	(C)	(A)	(B)	(C)
1 Man	B 8.1 ²			31 Raccoon	B 1.4 ³	
2 Camel	C 18.2 ²	5.1-10.4 ^{c2}		32 Rat	C 4.0 ³	
3 Cat	B 3.3 ²	14.3-24.6 ^{c2}		33 Sheep	B (6.6) ^{c2}	
4 Dog	C 13.5 ²			34 Canary	C 14.4 ^{c2}	
5 Elephant	B 3.8 ²	9-10 ²		35 Chicken	B (2.9) ²	
6 Guinea pig	C 9.6 ²			36 Duck	C 9.2 ²	
7 Goat	B (4.8) ²			37 Goose	B 24.7 ³	
8 Horse	C 10.7 ²			38 Pigeon	C 53 ³	
9 Kangaroo	B 4.0 ³			39 Turkey	B (4.7) ²	11.1-17.7 ^{c2}
10 Monkey	C 12.5 ³			40 Alligator	C 14.6 ²	
11 Mouse	B (5.8) ³			41 Snake, moccasin	B 12.0 ²	
12 Opossum	C 13.7 ³			42 Turtle, snapping	C 35 ²	
13 Ox	B 2.5 ²			43 Frog, bull	B 13.9 ³	
14 Pig	C 7.3 ²			44 Frog, green	C 32 ²	27-34 ^{c3}
15 Rabbit	B 1.6 ²			45 Necturus	B 15.4 ³	
	C 4.5 ²				C 34 ³	31-40 ^{c3}
	B 4.6 ³				B (9.8) ²	
	C 9.2 ³				C 26 ²	
	B (5.0) ³				B 1.5 ³	
	C 12.0 ³				C 9.0 ³	
	B (5.9) ³				B 25 ³	
	C 14.1 ³				C 121 ³	
	B (5.2) ³				B 4.4 ³	
	C 12.1 ³				C 18.1 ³	
	B (2.1) ²				B (5.8) ³	(5.2-6.3) ^{c3}
	C 5.1 ²				C 19.4 ³	17.6-20.9 ^{c3}
	B (14.2) ²				B 5.9 ³	
	C 34 ²				C 21.6	
	B (10.0) ²				C 12.3 ³	
	C 24 ²				C 66 ³	

(1) All determinations on whole blood, cell content calculated on hematocrit values. Calculated values in parentheses (not underscored). (2) (11) 42

1/ All determinations on whole blood, cell content calculated on basis of blood analysis and hematocrit values. Calculated values in parentheses (). The following figures represent first, the item, next, the hematocrit, standard (underscores) and/or value reported by investigator (not underscored). (1), 44.5, 45.2, (3), 24.3, (5), 40, 28.1, (7), 45.5, 34.2, (9), 32.2, (11), 42, 36.4, (13), 34.5, 27.7; (15), 35, 41, (17), 49.9; (19), 42, 42.6, (21), 41.5, 40, (23), 42.9, (25), 40, 39, (27), 41.5, 37, (29), 41.5, (31), 36.1; (33), 46, 48.8, (35), 32, 31.1; (37), 46.5, (39), 32, 32.2, (41), 34.5, (43), 44, 47.9; (45), 45.1, (47), 38, 39.7, (49), 13.8, (51), 20.2, (53), 24.1, (55), 30, 30.8; (57), 27.0, (59), 18.8. "Hydrolyzable" phosphorus determined by Lohmann method. Liberated P determined by Fiske-Subbarow method; these values were multiplied by 3/2 (Kerr & Daoud; Guest & Rapoport) to derive A. T. P. P values. 2/ De-hydrated blood. 3/ Heparinized blood.

83. BLOOD LIPID PHOSPHORUS

Blood (B); R B C (C); Plasma (P); Serum (S)

Animal	Phosphorus mg/100 ml		Animal	Phosphorus mg/100 ml	
	Value	Range		Value	Range
(A)	(B)	(C)	(A)	(B)	(C)
1 Man	B 11.2		4 Dog	C 14.7	
2					
3					
4					

/1/ Determined by Fiske-Subbarow method after treatment with Bloor's mixture.

/2/ Determined by Bell and Doisy method after Bloor's mixture. /3/ 4.8

(2.8-6.7) by Tisdall method after extraction in alcohol, then chloroform.

84. BLOOD HEXOSE PHOSPHATE PHOSPHORUS¹

Blood (B); R B C (C); Plasma (P)

Animal	Phosphorus mg/100 ml		Animal	Phosphorus mg/100 ml	
	Value	Range		Value	Range
(A)	(B)	(C)	(A)	(B)	(C)
1 Man	B 3.2	1.4-5.0	3 Man	P 0.04	0.0-0.22
2	C 7.5	3.5-10.7			

/1/ Hexose phosphate P = (P value after hydrolysis in N HCl for 180 minutes at 100°C) - (P value after hydrolysis in N HCl for 7 minutes at 100°C).

85. BLOOD PHYTIC ACID PHOSPHORUS¹

Blood (B); R B C (C)

Animal	Phosphorus mg/100 ml		Animal	Phosphorus mg/100 ml	
	Value	Range		Value	Range
(A)	(B)	(C)	(A)	(B)	(C)
1 Canary	B 26		8 Goose	C 71	
2	C 56		9 Pigeon	B 33	
3 Chicken	B 19.9		10	C 74	71-86
4	C 65	61-68	11 Turkey	B (31)	
5 Duck	B 31		12	C 74	
6	C 69		13 Turtle, snapping	B 6.1	
7 Goose	B (29)		14	C 25	

/1/ Found only in nucleated R B C. All determinations on heparinized whole blood by the Michel-Durand method as modified by Rapoport and Leva, values for R B C calculated on the basis of blood contents and hematocrit values. Parentheses () enclose values calculated on basis of standard hematocrit values.

86. BLOOD SULFUR

Blood (B), H B C (C); Plasma (P), Serum (S)

Constituent		Animal	Sulfur mg/100 ml		Constituent	Animal	Sulfur mg/100 ml	
			Value	Range			Value	Range
(A)	(B)		(C)	(D)	(A)	(B)	(C)	(D)
1 Sulfate S, total	Man	P	1.1	0.9-1.3	11 Inorganic S	Rabbit	P 5.0	3.6-6.1
	Rabbit	P	2.4	1.0-6.9		Rat	P 1.0	
3 Non-protein S	Man	P	2.8	2.4-3.6	13	Man	C 0.015	
	Rabbit	P	6.9	6.0-8.4	14	Man	P 0.1	0-0.2
4	Man	P	0.9	0.8-1.1	15	Cow	C 0.21	
5 Inorganic S	Cow	C	1.45		16	Dog	C 0.54	
6	Dog	C	1.35		17	Goat	C 0.15	
7	Dog	P	3.2		18	Rabbit	P 0.4	0.1-1
8	Goat	C	1.5		19	Organic S	P 1.7	1.4-2.6
10	Horse	P	3.4		20	Rabbit	P 1.6	1.0-2.1

/1/ Ethereal S.

87. BLOOD SULFUR COMPOUNDS

Blood (B), H B C (C), Plasma (P)

Constituent		Animal	Sulfur Compounds per 100 ml		Constituent	Animal	Sulfur Compounds per 100 ml	
			Value mg	Range mg			Value mg	Range mg
(A)	(B)		(C)	(D)	(A)	(B)	(C)	(D)
1 Sulfate, total	Man	P	3.3	2.7-3.9	23	Man	B (35)	25-41
	Rabbit	P	16.2	12-21	24	Man	C 79	
3	Man	P	2.7	2.4-3.3	25	Man	P 0.0	
4 Sulfate, inorganic	Dog	P	9.6		26	Cow	B 40	
	Horse	P	10.2		27	Cow	C (157)	
5	Rabbit	P	14.4	10.8-27	28	Cow	P 0.0	
6	Rat	B	3.0		29	Rat	B 40	30-45
7 Sulfate, conjugated ¹	Man	P	0.3	0-0.6	30	Rat	C (182)	(116-205)
8	Rabbit	P	1.2	0.3-3.0	31	Rat	P 0.0	
10 Cystine ²					32	Man	B (4)	
11	Man	B		1.9-5.5	33	Man	C 8.5	
12	Man	C	9.6	3.9-17.7	34	Man	P 0.0	
13 Ergothioneine ³	Man	P	0.0		35	Cow	B 6	
14	Pig	B (8.4)		(6.1-9.8)	36	Cow	C (24)	
15	Pig	C 20.7		15.6-24	37	Cow	P 0.0	
16	Pig	P 0.0			38 Indican	Man	P	0.0-0.6
17	Man	B (39) ⁶			39 Insulin ⁴			
18	Man	C 87			40 Methionine ⁵			
19	Man	P 0.0			41 Thiamine ⁵			
20	Cow	B 46			42 Thiocyanate	Man	B 0.77	0.5-1.4
21	Cow	C (181)						
22	Cow	P 0.0						

1/ Or ethereal sulfate 2/ See table on Free Amino Acid Content 3/ Or thioneine, present in R B C only.
4/ See table on Blood Hormone Content. 5/ See table on Blood Vitamin Content. 6/ Figures in parentheses
were calculated on basis of standard hematocrit values, see table on Hematocrit Values.

88. BLOOD VITAMINS

88. BLOOD VITAMINS									
Constituent	Animal	100 ml Blood		100 ml R B C		100 ml Plasma ¹			
		Value	Range	Value	Range	Value	Range		
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)		
1 Vitamin A	Man	13 µg	9-17 µg	0 ²		24 µg	10-60 µg		
2 as carotenol	Cow	14 µg	6-18 µg	0		24 µg	10-30 µg		
3	Dog	1.5 µg	0-3 µg	0		3 µg	0-5 µg		
4	Horse	8 µg	6-10 µg	0		12 µg	9-16 µg		
5	Pig	12 µg	5-20 µg	0		20 µg	10-35 µg		
6	Rabbit	25 µg	15-70 µg	0		10 µg	30-130 µg		
7	Rat	6 µg	4-70 µg	0		35 µg	6-12 µg		
8	Sheep	24 µg	14-31 µg	0		45 µg	20-45 µg		
9	Chicken	31 µg	10-68 µg	0		220 µg	15-100 µg		
10	Man	120 µg	20-300 µg	0		70 µg	40-540 µg		
11	Cow	40 µg	25-950 µg	0		100 µg	50-2000 µg		
12	Horse	65 µg	13-114 µg	0		10 µg	0-20 µg		
13	Pig	0		0	0.5-2.8 mg	50 µg	30-300 µg		
14	Sheep	7 µg		0		0.7 mg	0.1-2.5 mg		
15	Chicken	24 µg		0		0.5 mg	0.2-1.5 mg		
16	Man	0.62 mg	0-14 µg	0		0.5 mg	0.2-1.5 mg		
17	Cow	0.5 mg	20-200 µg	0		0.4 mg	0.2-1.2 mg		
18	Horse	0.5 mg	0.2-0.7 mg	0		0.5 mg	0.05-1.5 mg		
19	Pig	0.5 mg	0.2-1.5 mg	0		0.5 mg	0.4-0.8 mg		
20	Dog	0.4 mg	0.2-1.5 mg						
21	Rat	0.5 mg	0.2-1.2 mg						
22	Sheep	0.5 mg	0.2-2.1 mg						
23	Man	0.5 mg	0.1-1.5 mg						
24	Cow ⁵	0.08 µg	0.4-0.8 mg						
25	Dog	0.05 µg	0.06-0.14 µg						
26	Goat	0.09 µg	0.04-0.05 µg						
27	Horse	0.07 µg	0.05-0.11 µg						
28	Mouse ⁶	0.21 µg	0.06-0.09 µg						
29	Mouse ⁷	0.23 µg	0.12-0.34 µg						
30	Pig	0.12 µg	0.22-0.23 µg						
31	Rabbit	0.10 µg	0.09-0.14 µg						
32	Rat	1.01 µg	0.08-0.13 µg						
33	cotton	0.36 µg	0.64-1.50 µg						
34	Rat, white		0.33-0.38 µg						
35	Sheep	0.08 µg							
36	Chicken	0.07 µg	0.05-0.12 µg						
37	Turkey	0.56 µg	0.06-0.09 µg						
38	Turtle	0.53 µg	0.38-0.66 µg						
39	Man	0.66 µg	0.45-0.60 µg						
40	Mouse	1.23 µg	0.59-0.69 µg						
	Rat	1.25 µg	0.8-1.7 µg						
	Vitamin C, see Ascorbic acid								
	Carotene, -ol, see Vitamin A		1.5-3.5 µg						
41	Choline ³ , total								
42	Man				1.3 µg	1.0-1.7 µg			
43	Cow								
44	Dog								
45	Horse								
46	Mouse								
	Sheep	18.5 mg	11-31 mg						
					16.5 mg	26-35 mg			
					15 mg	12-15 mg			
					10 mg	8-15 mg			

1/ Or serum when specified
2/ Absence from R B C not conclusively established
3/ Not conclusively established
4/ Oxalated blood, determined by the method of Skeggs et al.
5/ In pasture fed cow, in dry lot fed calf, 0.05 µg
6/ Swiss albino
7/ Swiss albino

/1/ Or serum when specified /2/ Absence from R B C not conclusively established /3/ Determined by chemical methods. /4/ Oxalated blood, determined by the method of Skeggs et al, using Lactobacillus leichmanii as test organism /5/ In pasture fed cow, in dry lot fed calf, 0.09 (0.08-0.10) µg. /6/ American albino. /7/ Swiss albino

88. BLOOD VITAMINS (Continued)

	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)
47	Choline ¹ free	Man	2.5 mg	1.0-4.0 mg		4.4-7.5 mg		0.05-2.5 mg
48		Cow					4 mg	
49		Dog						1.0-1.1 mg
50		Guinea pig						2-12 mg ²
51		Horse					4 mg	
52		Pig					2.6 mg	
53		Rabbit					0.5 mg	
54	Vitamin D ³ as Calcif- erol (D ₂)	Rat						0.05-0.3 mg
55		Sheep					3 mg	1-4 mg
56		Man			1.4 µg		2.8 µg ²	1.7-4.1 µg ²
57		Cow					6.8 µg ²	
58		Dog					1.4 µg ²	
59	Vitamin E ¹ (Tocopherol)	Pig					3.0 µg ²	2.6-3.4 µg ²
60		Rabbit					1.3 µg ²	1.1-1.8 µg ²
61		Sheep					1.3 µg ²	1.1-1.8 µg ²
62		Chicken					2.5 µg ²	
63		Man					1.2 mg	0.9-1.9 mg ²
64	Folic acid, see Pteroylglutamic acid	Cow					0.40 mg ²	0.20-0.50 mg ²
65		Dog					0.6 mg	
66		Pig					0.1 mg	0.09-0.15 mg
67		Rat						0.05-0.06 mg
68		Sheep					0.02 mg	0.01-0.03 mg
69	Inositol ⁵	Man					0.50 mg	0.37-0.76 mg
70	Vitamin K	Mouse	6.6 mg					
71	Nicotinic acid ⁶	Man	0.6 mg ^{7,8}	0.2-0.9 mg ^{1,9}	1.3 mg ¹⁰		0.075 mg ¹	0.025-0.15 mg ¹
72		Cow	0.3 mg ⁷					
73		Dog	0.8 mg	0.5-1.3 mg ¹¹	1.6 mg			
74		Guinea pig		6.5-8.9 mg ¹²				
75		Horse	0.6 mg ^{7,13}					
76		Ox	0.9 mg ⁷					
77		Pig	0.5 mg ⁷					
78	Pantothenic acid ⁶	Rat	1.4 mg ⁷	1.2-1.8 mg				
79		Sheep	1.0 mg ⁷	0.4-1.4 mg ⁴				
80		Chicken	1.1 mg ⁷	1.0-1.2 mg ⁴				
81		Man	30 µg	15-45 µg	25 µg	15-30 µg	15 µg	6-35 µg
82		Dog	25 µg	15-35 µg	25 µg	20-30 µg	30 µg	15-40 µg
83	Pantothenic acid ⁶	Horse	45 µg	35-55 µg	52 µg	45-60 µg	38 µg	30-45 µg
84		Pig	35 µg	30-40 µg	30 µg	25-35 µg	35 µg	30-40 µg
85		Rabbit	20 µg	15-35 µg				20-30 µg
86		Sheep	35 µg	20-50 µg	30 µg	20-40 µg	25 µg	20-30 µg
87		Chicken	45 µg	40-50 µg				

/1/ Determined by chemical method. /2/ Content in serum. /3/ Determined by animal assay method. /4/ 6.5-10.5 mg coenzyme. /5/ Determined by microbiological method with Neurospora. /6/ Determined by microbiological method. /7/ Total nicotinic acid activity. /8/ 3.0 as coenzyme. /9/ 2.0-3.5 mg as coenzyme. /10/ 0.135 mg free nicotinic acid. 7.0 (6.5-9.0) mg as coenzyme. /11/ 5.1-6.6 mg as coenzyme. /12/ As coenzyme. /13/ 0.27 mg free nicotinic acid.

88. BLOOD VITAMINS (Concluded)

	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)
88	Para-amino benzoic Acid ¹	Man	3.4 µg					
89		Mouse	29 µg					
90		Man	3.5 µg	2.3-5.3 µg			1.7 µg	1.5-5.0 µg
91	Pteroylglutamic acid ¹	Cattle		2.1-3.0 µg				1.8-2.2 µg
92	total ²	Pig		2.3-3.1 µg				1.8-2.1 µg
93		Sheep	4.6 µg	3.5-5.5 µg				
94		Chicken		2.2-4.3 µg				3.0-4.2 µg
95		Man	0.085 µg	0.05-0.13 µg			0.05 µg	
96	Pteroylglutamic acid ¹ , free	Cattle	0.19 µg	0.06-0.45 µg			0.05 µg	
97		Horse	0.33 µg	0.22-0.6 µg			0.35 µg	0.25-0.48 µg
98		Pig	0.66 µg	0.45-0.99 µg			0.61 µg	0.48-0.87 µg
99		Chicken	0.87 µg	0.44-1.65 µg			0.31 µg	0.14-0.42 µg
100		Turkey	1.68 µg	1.02-2.76 µg			0.6 µg	0.25-1.08 µg
101	Pyridoxine	Monkey	11 µg	5-20 µg	5 µg	2-21 µg	6 µg	1-18 µg
102		Mouse	42 µg					
103		Sheep	12 µg					
104		Man		15-60 µg ¹	22.4 µg ³	18-26 µg ³	3.2 µg ³	2.6-5.7 µg ³
105		Dog	97 µg ¹	90-100 µg ¹				
106		Cow, young	45 µg ¹	40-50 µg ¹				
107	Riboflavin	Pig	95 µg ¹					
108		Rat	45 µg ¹	20-65 µg ^{1,5}		100-130 µg ^{1,6}		
109		Sheep	27 µg ¹	24-30 µg ¹				
110		Chicken	15 µg ⁶	12-18 µg ⁶			34 µg ⁶	31-35 µg ⁶
111		Snake		0-310 µg ¹				
112		Man ♂	8.9 µg ¹²	6.1-10.7 µg ^{1,6}	10 µg ¹	7-14 µg ¹²		
113		Man ♀	7.6 µg ¹²	6.2-9.0 µg ¹²	6.5 µg ¹	5-8 µg ¹²		
114		Man	8.0 µg ⁸	4-11 µg ⁸	8.0 µg ⁸	7-10 µg ⁸	7 µg ⁸	1-9 µg ⁸
115		Cow	8 µg ^{8,9}	5-11 µg ^{8,10}				
116		Dog	7.0 µg	5-9 µg ⁸			2.10 µg ⁸	0.1-4.0 µg ⁸
117		Guinea pig		45-80 µg ¹²				
118	Thiamine ¹	Horse		1.1-1.7 µg ¹²				
119		Ox		4.5-5.1 µg ¹²				
120		Pig	20 µg ⁸	17-30 µg ¹¹				
121		Rabbit		3-30 µg ⁸				
122		Rat	20.5 µg ¹²	10-25 µg ¹²				
123		Sheep	5.8 µg ⁸	3-15 µg ^{7,8}			3.8 µg ⁸	
124		Chicken	6.0 µg ¹²	5.6-11 µg ¹²				
125		Pigeon	29 µg ⁸	21-40 µg ⁸				14-22 µg ⁸
126		Frog	9.0 µg ¹²					
127		Snake			(80 µg) ¹³			
Totopherol, see Vitamin E								

/1/ Determined by microbiological method. /2/ Takadiastase treated samples /3/ Determined by Burch-Beasley-Lowry fluorometric method /4/ As coenzyme. /5/ 50-65 µg coenzyme /6/ Determined by fluorometric method. /7/ 4-4.7 µg thiamin pyrophosphate /8/ Total thiamin /9/ 0.5 µg free thiamin. /10/ 0-0.1 µg free thiamin. /11/ 12-20 µg thiamin pyrophosphate /12/ As thiamin pyrophosphate. /13/ In 1 g RBC.

Constituent		Animal	100ml Blood (B) Plasma (P), R.B.C (C)
31	Non-epinephrin H 21	Man, Cow	Value
32	Parathormone	Man, Dog	Range
33	Pituitary H 22	Man	(C)
34	Pituitary H 23	Man	(D)
35	"Pregnant" Mare's Serum H 24	Man	2-4 µg
36	Progesterone	Woman, pregnant	4300-13200 lu
37	Relaxin	Woman, pregnant	330 µg ²⁷
38	Relaxin	Woman, luteal phase	30-700 µg ^{28,29}
39	Relaxin	Rabbit, luteal phase	600 µg ²⁷
40	Relaxin	Rabbit, pseudo-preg	20-320 µg ^{27,29}
41	Relaxin	Rooster, pregnant	600 µg ²⁷
42	Relaxin	Horn, ovulating	300 µg ²⁷
43	Relaxin	Woman, pregnant	300 µg ²⁷
44	Relaxin	Guinea pig, preg.	300 µg ²⁷
45	Relaxin	Sow, preg.	300 µg ²⁷
46	Relaxin	Man, preg.	300 µg ²⁷
47	Relaxin	Man, adult	300 µg ²⁷
48	Relaxin	Man, 3-13 yr.	300 µg ²⁷
49	Relaxin	Dog	300 µg ²⁷
50	Relaxin	Rat	300 µg ²⁷
51	Relaxin	Mouse	300 µg ²⁷
52	Relaxin	Guinea pig	300 µg ²⁷
53	Relaxin	Horse	300 µg ²⁷
54	Relaxin	Monkey	300 µg ²⁷
55	Relaxin	Chicken	300 µg ²⁷
56	Relaxin	Man	300 µg ²⁷
57	Relaxin	Man	300 µg ²⁷
58	Relaxin	Man	300 µg ²⁷
59	Relaxin	Man	300 µg ²⁷
60	Relaxin	Man	300 µg ²⁷
61	Relaxin	Man	300 µg ²⁷
62	Relaxin	Man	300 µg ²⁷
63	Relaxin	Man	300 µg ²⁷
64	Relaxin	Man	300 µg ²⁷
65	Relaxin	Man	300 µg ²⁷
66	Relaxin	Man	300 µg ²⁷
67	Relaxin	Man	300 µg ²⁷
68	Relaxin	Man	300 µg ²⁷
69	Relaxin	Man	300 µg ²⁷
70	Relaxin	Man	300 µg ²⁷
71	Relaxin	Man	300 µg ²⁷
72	Relaxin	Man	300 µg ²⁷
73	Relaxin	Man	300 µg ²⁷
74	Relaxin	Man	300 µg ²⁷
75	Relaxin	Man	300 µg ²⁷
76	Relaxin	Man	300 µg ²⁷
77	Relaxin	Man	300 µg ²⁷
78	Relaxin	Man	300 µg ²⁷
79	Relaxin	Man	300 µg ²⁷
80	Relaxin	Man	300 µg ²⁷
81	Relaxin	Man	300 µg ²⁷
82	Relaxin	Man	300 µg ²⁷
83	Relaxin	Man	300 µg ²⁷
84	Relaxin	Man	300 µg ²⁷
85	Relaxin	Man	300 µg ²⁷
86	Relaxin	Man	300 µg ²⁷
87	Relaxin	Man	300 µg ²⁷
88	Relaxin	Man	300 µg ²⁷
89	Relaxin	Man	300 µg ²⁷
90	Relaxin	Man	300 µg ²⁷
91	Relaxin	Man	300 µg ²⁷
92	Relaxin	Man	300 µg ²⁷
93	Relaxin	Man	300 µg ²⁷
94	Relaxin	Man	300 µg ²⁷
95	Relaxin	Man	300 µg ²⁷
96	Relaxin	Man	300 µg ²⁷
97	Relaxin	Man	300 µg ²⁷
98	Relaxin	Man	300 µg ²⁷
99	Relaxin	Man	300 µg ²⁷
100	Relaxin	Man	300 µg ²⁷

(1) "ACTH" (2) By adrenal ascorbic acid depletion (3) Reliable values not available for androstosterone, estril and estrone, as such, for the purpose of this assay. (4) By adrenal ascorbic acid depletion (5) By adrenal ascorbic acid depletion (6) By adrenal ascorbic acid depletion (7) By adrenal ascorbic acid depletion (8) By adrenal ascorbic acid depletion (9) By adrenal ascorbic acid depletion (10) By adrenal ascorbic acid depletion (11) By adrenal ascorbic acid depletion (12) By adrenal ascorbic acid depletion (13) By adrenal ascorbic acid depletion (14) By adrenal ascorbic acid depletion (15) By adrenal ascorbic acid depletion (16) By adrenal ascorbic acid depletion (17) By adrenal ascorbic acid depletion (18) By adrenal ascorbic acid depletion (19) By adrenal ascorbic acid depletion (20) By adrenal ascorbic acid depletion (21) By adrenal ascorbic acid depletion (22) By adrenal ascorbic acid depletion (23) By adrenal ascorbic acid depletion (24) By adrenal ascorbic acid depletion (25) By adrenal ascorbic acid depletion (26) By adrenal ascorbic acid depletion (27) By adrenal ascorbic acid depletion (28) By adrenal ascorbic acid depletion (29) By adrenal ascorbic acid depletion (30) By adrenal ascorbic acid depletion (31) By adrenal ascorbic acid depletion (32) By adrenal ascorbic acid depletion (33) By adrenal ascorbic acid depletion (34) By adrenal ascorbic acid depletion (35) By adrenal ascorbic acid depletion (36) By adrenal ascorbic acid depletion (37) By adrenal ascorbic acid depletion (38) By adrenal ascorbic acid depletion (39) By adrenal ascorbic acid depletion (40) By adrenal ascorbic acid depletion (41) By adrenal ascorbic acid depletion (42) By adrenal ascorbic acid depletion (43) By adrenal ascorbic acid depletion (44) By adrenal ascorbic acid depletion (45) By adrenal ascorbic acid depletion (46) By adrenal ascorbic acid depletion (47) By adrenal ascorbic acid depletion (48) By adrenal ascorbic acid depletion (49) By adrenal ascorbic acid depletion (50) By adrenal ascorbic acid

determination of serum acetoacetic acid depletion
trophic activity of 100 mg pregnant uric acid depletion
bit, east, pig, except as specified, exp preparation dete
supravital in blood, traceable in general clinical
1/3 months, 19/74 By acet demobilized as desorg
menopause, /19/74 By acet demobilized in general clinical
6-8 weeks, /19/74 By acet demobilized in general clinical
2/5, "PMS," /56, 8, /22, "Oncipin," one unit equivalent
progestins rose, 30-45g wets, /27, "Oncipin," one unit equivalent
detected plasma of Cysto, horse, 30-45g wets, /31, only on
stasis method of D'Angelo, Gordon, Gordon, pig, pigoon
cogen method of Vanning, /31, 0.35-0.42% Cytologic
non-pregnant woman, /41/L T. Samuels reports values

90. BLOOD ENZYME ACTIVITY

Blood (B), RBC (C), Plasma (P), Serum (S)

Variable

	(A)	Animal	Enzyme Activity per 100 ml		Variable	Animal	Enzyme Activity per 100 ml	
			Value (C)	Range (D)			Value (C)	Range (D)
1	Adenosine deaminase	Rabbit	B		Carbonic anhydrase (continued)	Cattle	C	
2	Adenosine phosphatase, acid	Man	S	4151		Calf	C	
3	Adenosine phosphatase, alkaline	Man	S	412		Guinea pig	C	80,000-140,000
4	Adipic acid deaminase, muscle	Rabbit	B	302	10-51b	Rat	C	60,000
5	Aldolase	Man	S	413		Man	C	59,000
6	Amylase	Rat, albino	C	4904		Chicken	C	144,000
7		Man	S	90,000	350-800d	Man	C	22,000
8		Man	S	6,000		Cow	S	0.18
9		Man	S	70,000-110,000d				600
10		Man	S	4,000-9,000d				202,000
11		Man	S	60-150				81,600-469,200
12		Man	S	2,500-7,700b				273-4071
13	Arginase	Monkey	P	1,800-7,000b				5491
14		Mouse	P	800-3,200b				1761
15		Rat	P					139-6601
16		Man	C					133-3621
17		Man	C					92-1402
18		Man	C					112-302
19		Man	C					125-2302
		Man	C					248-3102
		Man	C					430-6852
		Man	C					4012
		Man	C					2531
		Man	C					18-352
		Man	C					28-782

11/ μ g N liberated/hr. /2/ μ M P from ATP/hr at pH 4.8 for acid adenosine phosphatase, and at pH 6.9 for alkaline adenosine phosphatase. Corrected for inorganic P and non-enzymatic hydrolysis. /3/ μ g N liberated/hr in presence of 0.05% adenylic acid, starch and fructose diphosphate/hr at 38°C at pH 6.6. No change in pregnancy. /5/ mg dextrose or equivalent (by copper reduction) from time of uncatalyzed reaction at 30°C under specified conditions. /6/ Units as described by Kochakian. Fall in newborn, paratuberculosis. /7/ Amount of RBC that will halve the acetylcholine hydrolyzed/30 sec under specified conditions. /8/ g/100 g dry weight. /9/ Units described by Dille et al. /10/ mg H_2O_2 split/10 min under conditions in all conditions in per min from 0.01M acetylcholine. /11/ μ M acetylcholine hydrolyzed/min from 0.01M acetylcholine. /12/ μ M acetylcholine hydrolyzed/min from 0.0025M acetylcholine. /13/ μ M acetylcholine hydrolyzed/min from 0.0025M acetylcholine.

90. BLOOD ENZYME ACTIVITY (Continued)

Blood (B); RBC (C); Plasma (P); Serum (S)

Variable	Animal	Enzyme Activity per 100 ml		Variable	Animal	Enzyme Activity per 100 ml	
		Value	Range			Value	Range
(A)	(B)	(C)	(D)	(A)	(B)	(C)	(D)
45	Man	C 261	69		Man	C Trace	
46		P 5.8	70			P 110	
47	Cat	C 12.1	71		Cat	C 0	
48		P 16.2	72			P 45	
49	Cow	C 211	73		Cow	C Trace	
50		P Trace	74			P Trace	
51	Dog	C 61	75		Dog	C 0	
52		P 14.8	76			P 144	
53	Guinea pig	C 153	77		Guinea pig	C Trace	
54		P 16.6	78			P 60	
55	Horse	C 81	79		Horse	C Trace	
56		P 8.1	80			P 243	
57	Rabbit	C 34	81		Rabbit	C 0	
58		P 25.2	82			P 19.8	
59	Rat	C +	83		Rat	C 0	
60		P 16.2	84			P 5.8	
61	Sheep	C 76	85		Sheep	C 0	
62		P 13.0	86			P 0	
63	Fowl	C Trace	87		Fowl	C Trace	
64		P 72	88			P 4.5	
65	Labrus (bony fish)	C 0	89		Labrus (bony fish)	C Trace	
66		P 0.3	90			P Trace	
67	Scyllium (elasmobranch)	C 0	91		Scyllium (elasmobranch)	C 0	
68		P 7.6	92			P Trace	

/14/ μ M acetyl-beta-methylcholine hydrolyzed/min as measured by volume CO_2 evolved/min from 0.03M acetyl-beta-methylcholine. /15/ μ M benzoylcholine hydrolyzed/min as measured by volume CO_2 evolved/min from 0.006M benzoylcholine. /16/ Where figures in literature reported in terms of whole blood, hematocrit values of 45 assumed in present conversion. /17/ RBC cholinesterase activity high in reticulocytes and young cells; high in conditions accompanied by hyperactive hematopoiesis.

90. BLOOD ENZYME ACTIVITY (Concluded)

Blood (B), R B C (C), Plasma (P), Serum (S)

Variable	Animal	Enzyme Activity per 100 ml		Variable	Animal	Enzyme Activity per 100 ml	
		Value (C)	Range (D)			Value (C)	Range (D)
93 Dehydrogenase	Man	S	35918	106 Lipase	Man	S	0-15022
94 Glucose-6-phosphate dehydrogenase	Rat	C	191-527	107 Melanogobulin reductase	Rabbit	C	+
95 Beta-Glucuronidase	Man	S	+	108 Phenolsulphatase	Man	S	30-1,55023
96				109 Phosphatase, acid	Man	S	1.0-4.024
97				110	Man, adult	S	10.5-13.023
98				111 Phosphatase, alkaline ²	Man, adult	S	1.0-4.026
99				112	Man, child	S	5.0-14.028
100				113 Prothrombin	Man	P	50-12529
101 Hexoninase	Rat	C	1,398,000.20	114 Vitamin B ₁₂ cofactor	Man	P	80-10030
102							
103							
104							
105							

/18/ μ MNH₃/30 min from DL-alanyldehydroalanine at 37°C at pH 8.1. /19/ μ g phenolphthalein/hr from phenolphthalein-glucuronide at 36°C at pH 4.5. Rise in pregnancy from 300 μ g at 3 mos. to 1350 μ g at term. /20/ μ l CO₂/20 min from methylglyoxal at pH 7.2 from standard olive oil emulsion. /21/ μ g histamine destroyed in 90 min at 37°C. Rise in pregnancy. /22/ ml N/20 NaOH/24 hr phenyl sulphate. /23/ mg phenol/hr from disodiumphenylphosphate which produces color equivalent to 10 μ g of p-nitrophenol at pH 7.2. /24/ mg P/hr from disodiumphenylphosphate at 37°C at pH 9.0. /25/ mg P/hr from beta-glycerophosphate at 37°C at pH 5.0. /26/ mg P/hr from beta-glycerophosphate at 37°C at pH 8.6. /27/ Rise in oestroblastic activity and a 0.1% fibrin clot in 120 seconds at 28°C at pH 7.2 in isotonic saline buffered with imidazole. /30/ μ g folic acid/90 min from yeast extract at 37°C at pH 4.5.

91. BLOOD COENZYMES

Blood (B); RBC (C); Plasma (P)

91. BLOOD COENZYMES						
Blood (B); RBC (C); Plasma (P)						
Variable	Animal	μg/100 ml		Method		
		Value	Range			
(A)	(B)	(C)	(D)	(E)		
1 Coenzyme A (as bound pantothenic acid)	Man	C		210-280 ^c	Acetylation of sulfanilamide	
2	Man ¹	B	7.0	2.8-11.2 ^b	Manometric determination of CO ₂ evolved from pyruvate	
3 Ox ¹	B	5.7	2.7-8.7 ^b			
4 Pigeon ¹	B	20.2	0.6-40 ^b			
5	Man ♂	B	8.9	7.0-14.0 ^c	Microbiological assay	
6	Man ♀	B	10.0 ²	5.0-8.0 ^c		
7	Cattle, young	B	7.6	7.9-10.1 ^c		
8	Guinea pig	B	6.5 ²	45-80 ^c		
9	Horse	B				
10	Ox	B				
11	Rat, albino	B	20.5	1.1-1.7 ^c		
12	Sheep	B		4.5-5.1 ^c		
13	Swine	B		10-25 ^c		
14	Chicken	B		4.0-4.7 ^c		
15	Frog	B	6.0	12-20 ^c		
16	Man	C	9.0	5.6-11.0 ^c		
17			75			
18	Man	C				
19	Flavine adenine dinucleotide	P	10		Modification of alanine test of Warburg & Christian	
20	Rat, albino	B			Microbiological assay	
21	Pyridine nucleo- tide, total (as DPN) ³	Man	B	3600	Alkaline acetone method	
22		C	7700	2600-4600 ^b		
23		P	70	6100-9300 ^b		
				20-120 ^c		

/1/ All blood cocarboxylase is intracellular. /2/ Sex difference in values is significant, males have 1.49 μg/100 billion RBC. /3/ Ratio of DPN/TPN in RBC is entirely in RBC.

/1/ All blood cocarboxylase is intracellular. /2/ Sex difference in RBC cocarboxylase values is significant, males have 1.49 $\mu\text{g}/100$ billion RBC; females have 1.28 $\mu\text{g}/100$ billion RBC. /3/ Ratio of DPN/TPN in RBC is estimated to be about 8/1, DPN is present almost entirely in RBC.

92. BLOOD ELECTROLYTES

Blood (B); R = C.; (C); Plasma (P); Serum (S); Colonic Fluid (F)

Constituent	Animal	Electrolytes mEq per 1000 ml ¹		Constituent	Animal	Electrolytes mEq per 1000 ml ¹	
		Value	Range			Value	Range
(A)	(B)	(C)	(D)	(A)	(B)	(C)	(D)
1	Man	B	72-91	16	Duck	B	4.8
2	Man	B	8.7-28.6	37	Toad	B	3.9
3	Man	S	18.6-23	38	Man	C	4.8
4	Man	S	132-144	39	Man	S	4.3-5.2
5	Cat	B	187-156	40	Man	S	4.0-5.3
6	Dog	B	(118-136)	41	Dog	S	4.7-6.1
7	Dog	C	90-104	42	Dog	S	4.2-5.6
8	Dog	P	150-163	43	Guinea pig	S	3.7-5.8
9	Monkey	B	143	44	Guinea pig	S	4.8-6.2
10	Monkey	B	137-149	45	Rabbit	S	7.2
11	Monkey	P	86-103	46	Rat	P	6.2
12	Monkey	P	183	47	Rat	S	5.4-7.3
13	Rabbit	P	136-177	48	Rat	S	5.8-6.3
14	Rat	S	136	49	Chicken	S	6.1
15	Chicken	B	135-135	50	Pigeon	S	5.6
16	Chicken	B	(98-121)	51	Man	B	5.3
17	Chicken	C	12.3-27.9	52	Man	S	(3.0-3.7)
18	Man	B	140-175	53	Man	S	1.6-6.7
19	Man	C	39-62	54	Man	S	1.7-1.9
20	Man	C	89-101	55	Cat	C	3.1
21	Man	S	4.2	56	Cat	S	4.4
22	Cat	S	4.3	57	Cattle	S	2.2
23	Dog	B	(6.0)	58	Cattle	S	1.7
24	Dog	C	4.9-9.6	59	Cattle	S	1.2
25	Dog	P	8.0	60	Dog	S	2.3
26	Guinea pig	P	4.2-11.8	61	Dog	S	(2.7)
27	Guinea pig	B	3.7-5.8	62	Dog	S	3.7
28	Guinea pig	B	6.5	63	Dog	S	1.87
29	Monkey	B	46-62	64	Guinea pig	S	1.9
30	Monkey	C	96-131	65	Guinea pig	S	(5.6)
31	Monkey	P	4.9-8.7	66	Guinea pig	S	8.1
32	Rabbit	P	5.15	67	Guinea pig	S	4.0
33	Rat	P	5.95	68	Hamster	S	2.1
34	Rat	S	5.1	69	Hedgehog	P	2.7
35	Chicken	B	(17-50)		Horse	B	(3.6)
	Chicken	C	106-143				
	Chicken	P	6.0				

Values in parentheses () were calculated from contents in blood cells and plasma on basis of hematocrit values. /1/ To convert mEq/1000 ml to mg/100 ml, multiply mEq values by 2.3 for sodium, 3.9 for potassium, 2.0 for calcium, 1.2 for magnesium, 3.3 for chloride, 2.3 for bicarbonate, 1.8 for phosphate, 1.8 for sulfate. /2/ Determined by chemical method. /3/ Determined by flame photometry. /4/ Determined by zinc ureanyl acetate (Barter and Tappin) method. /5/ Determined by colorimetric method of Shohl and Benedict. /6/ Determined by Tisdall method = modification. /7/ Calculated from value of phosphate determined by method in footnote 12, after precipitation of magnesium as magnesium ammonium phosphate as described by Hales.

92. BLOOD ELECTROLYTES (Concluded)

Blood (B); R B C (C); Plasma (P); Serum (S); Cerebro Fluid (F)

Constituent	Animal	Electrolytes mEq per 1000 ml		Constituent	Animal	Electrolytes mEq per 1000 ml	
		Value	Range			Value	Range
(A)	(B)	(C)	(D)	(A)	(B)	(C)	(D)
70	Horse	C	5.6	105	Homarus vulgaris	H	8.3
71	Horse	P	2.0	106	Mollusks;	B	116
72	Horse	S	2.2	107	Doris tuberculata	B	17.5
73	Mouse	C	9.8	108	Arthropoda'	B	99
74	Mouse	S	6.3	109	Honeybee larva	B	101
75	Pig	B	4.6	110	Limulus	P	71-87
76	Pig	C	6.4	111	Echinodermata.	P	101
77	Pig	S	2.2	112	Echinus esculentus	P	101
78	Rabbit	B	4.4	113	Man	C	111
79	Rabbit	C	6.0	114	Man	C	111
80	Rabbit	P	2.0	115	Man	C	111
81	Rat	B	(4.8)	116	Man	C	111
82	Rat	C	7.1	117	Man	C	111
83	Rat	P	2.9	118	Man	C	111
84	Rat	S	2.6	119	Man	C	111
85	Sheep	C	2.3	120	Man	C	111
86	Sheep	B	2.0	121	Man	C	111
87	Sheep	P	1.9	122	Man	C	111
88	Chicken	C	(4.0)	123	Man	C	111
89	Chicken	B	7.7	124	Man	C	111
90	Chicken	P	2.3	125	Man	C	111
91	Pigeon	C	(17)	126	Man	C	111
92	Pigeon	P	2.0	127	Man	C	111
93	Pigeon	B	(6.6)	128	Man	C	111
94	Turtle	C	20.1	129	Man	C	111
95	Turtle	P	2.8	130	Man	C	111
96	Turtle	B	(5.6)	131	Man	C	111
97	Frog	C	13.2	132	Man	C	111
98	Frog	P	2.3	133	Man	C	111
99	Frog	S	1.8	134	Man	C	111
100	Frog	S	3.4	135	Man	C	111
101	Salmon	S	9.1	136	Man	C	111
102	Spheroides asculatus	S	9.1	137	Man	C	111
103	Lepidosteus osteops	S	0.6	138	Man	C	111
104	Crustacea:	B	113	139	Man	C	111
	Maja serrucosa	B	113	140	Man	C	111

/9/ Determined by absorption indicator method of Saffer and Kornblum and checked by method of Van Slyke and Sendroy. /9/ Determined by mercurimetric method of Schales and Schales. /10/ Determined by method of Van Slyke and Neill. /11/ Determined by micro-diffusion method.

93. BLOOD MINOR MINERALS

		Blood (B), R B C (C), Plasma (P), Serum (S); Leukocytes (L)									
Constituent		Animal		$\mu\text{g}/100 \text{ ml}$				Constituent		Animal	
(A)		(B)		Value		Range		(A)		(B)	
				(C)		(D)				$\mu\text{g}/100 \text{ ml}$	
										Value	
										(C)	
										Range	
										(D)	
1	Aluminum ¹	Man	B	15				30	Iodine,	Man	S
2		Man	C	7	-40			31	precipitable	Rat	S
3		Man	P	46	-17			32			
4	Bromine ²	Man	S		-88			33			
5		Man	B		0.7-1.0			34	Iron ⁶	Man	S
6		Man	C	943	73-1133			35		Man	S
7		Man	P	753	49-1013			36		Man	B
8		Cow	F	1103	76-1433			37		Pig	P
9		Ewe	B		820-1400			38		Rat	P
10		Hen	S		730-1450			39	Lead ⁴	Man	B
11	Copper	Horse	S	14				40		Man	C
12		Horse	S	36	34-37			41		Man	P
13		Ox	S	38	31-41			42		Rabbit	B
14		Pig	S	34	33-35			43	Manganese ¹	Rabbit	P
15		Rabbit	P	206	153-2593			44		Man	B
16		Rabbit	B	85	74-99			45		Man	C
17		Rabbit	C	67	51-86			46		Man	P
18		Rat	S	320				47		Rat	B
19		Man	B		(28)	(11-45)		48	Silicon ⁷	Man	B
20	Fluorine	Man	C	27	11-44			49		Dog	B
21		Man	P	28	10-45			50		Horse	B
22		Dog	C	174	9-244			51	Silver ¹	Horse	S
23		Dog	P	254	12-354			52		Rabbit	B
24		Man	B	7.7	3-133			53		Rabbit	P
25		Man	C	7.1	4.8-8.6			54	Tin ¹	Man	B,C
26		Chicken	P	7.2				55		Man	B
27	Iodine,	Dog	S	29	14-52			56		Man	C
28	total	Guinea pig	B	7.3				57	Zinc ⁹	Man	P
29		Mouse	P	4.5				58		Man	B
		Rat	P	3.4	3.3-3.5					Man	C
										Man	P
										Man	L

^{1/1} Determined by spectrochemical methods after ashing. These values relative to volume, derived from gravimetric methods on basis of assumed blood specific gravity of 1.056. ^{2/2} Gold chloride added to filtrate. ^{3/3} Determined by unpublished method of Gubler, Lahey, Ashenbrucker, Wintrobe, and Cartwright. ^{4/4} Micrograms per 100 g. ^{5/5} After alkaline ashing. ^{6/6} Determined by methods of Kitzes, Elvehjem, and Schutte, and of Barkan and Walker. ^{7/7} Heparinized blood stored in cellophane tube, unless specified otherwise. ^{8/8} Defibrinated blood. ^{9/9} Determined by modified dithione method.

94 BLOOD GASES MAN¹

Variable		Whole Blood			ml Gas in 100 ml RBC	ml Gas in 100 ml Plasma	Blood Gas Pressure (Tension) mm Hg	Factors and Constants	
		ml Gas in 100 ml Whole Blood	ml Gas in 45 ml RBC	ml Gas in 55 ml Plasma					
(A)		(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)
1	Oxygen Capacity ⁵	20.46			145.3 ⁶				
2		18.0 ^{6,7}			145.3 ⁶				
3	Total Oxygen	Arterial ¹	20.3 ^{8,12}	20.1	0.142	44.7	0.258		
4		Arterial ¹	17.9	17.7	0.155	44.7	0.258		
5		Venous ¹²	15.3	15.2	0.060	33.9	0.110		
6		Venous ¹²	13.7	13.6	0.068	34.4	0.113		
7	"Free" Oxygen	Arterial ¹	0.28 ¹⁰	0.144	0.142	0.319	0.258		
8		Arterial ¹	0.28 ¹⁰	0.126	0.156	0.319	0.258		
9		Venous ¹²	0.122	0.061	0.061	0.156	0.110		
10		Venous ¹²	0.124	0.055	0.068	0.139	0.113		
11	Combined Oxygen (libO ₂)	Arterial ¹	20.0	20.0	0	44.4	0		
12		Arterial ¹	17.6	17.6	0	44.4	0		
13		Venous ¹²	15.2	15.2	0	33.6	0		
14		Venous ¹²	13.6	13.6	0	34.3	0		
15	Total Carbon Dioxide	Arterial ¹	49.0	16.2	32.8	36.0	59.6 ¹⁷		
16		Arterial ¹	48.0 ¹⁷	13.6	34.4	34.3	57.0 ¹⁷		
17		Venous ¹²	53.1	18.0	35.1	40.1	63.0		
18		Venous ¹²	51.4	14.9	36.5	37.7	60.4 ¹⁷		
19	"Free" Carbon Dioxide	Arterial ¹	2.424	1.960	1.564	2.356	2.844		
20		Arterial ¹	2.532	0.891	1.641	2.250	2.717		
21		Venous ¹²	2.997	1.213	1.786	2.690	3.248		
22		Venous ¹²	2.785	0.965	1.820	2.437	3.013		
23	Total Combined Carbon Dioxide	Arterial ¹	46.6	19.1	31.2	31.6	56.8		
24		Arterial ¹	45.5	12.7	32.8	32.1	54.3		
25		Venous ¹²	50.1	16.0	33.3	37.4	60.5 ¹⁸		
26		Venous ¹²	48.6	14.9	34.7	35.3	57.4		
27	Carbamino Carbon Dioxide	Arterial ¹	2.230	1.7	0.4	3.9	0.8		
28		Arterial ¹	1.90	1.3	0.5	3.7	0.8		
29		Venous ¹²	3.3	2.6	0.8	5.8	0.6		
30		Venous ¹²	2.7	2.2	0.8	5.5	0.8		
31	Litharbonate Carbon Dioxide	Arterial ¹	48.2	13.4	30.8	29.8	56.0		
32		Arterial ¹	46.6	11.2	32.3	28.3	53.5		
33		Venous ¹²	47.0	14.2	32.8	31.6	59.7		
34		Venous ¹²	46.0	11.8	34.2	29.6	56.6		
35	Nitrogen	Arterial ¹	0.979	0.494	0.484	1.099	0.881		
36		Arterial ¹	0.970	0.437	0.534	1.103	0.886		
37		Venous ¹²	0.979	0.494	0.484	1.099	0.881		
38		Venous ¹²	0.970	0.437	0.534	1.103	0.886		

/1/ The values from which this table has been synthesized are in many instances derived by calculation from basic assumptions, factors and constants, and do not have the same validity as actually measured values. Those for women are in general less well founded than for men. Values for carbamino CO₂ in particular, indicate order of magnitude rather than exact magnitudes. /2/ Assumed normal values, lower than hematological standards in Table 37, partially due to rise in plasma volume in recumbent posture. (vs. standing). /3/ Exact value used in calculations = 39.0 and 39.4. /4/ 100ml RBC in contact with plasma, and 100ml plasma in contact with RBC. /5/ O₂ capacity = grams lib = 1.34. This factor based on hemoglobin Fe content of 0.33%. /6/ Based on assumed hemoglobin concentration. /7/ Exact.

for plasma, "c" is calculated from K_c carbamino (x1.2) and the mEq of plasma proteins (x17.0). /23/ Arterial H₂ pressure (assumed) as equal to alveolar air H₂ pressure, the latter calculated by difference between 760 and sum of following: O₂ + 105 CO₂ + 441, 5% water vapor + 47. Venous H₂ taken as equal to arterial. Note that the total of blood gases and water vapor falls short of 760 in both arterial and venous bloods. 20, ml H₂ dissolved in 100ml RBC = 0.0146 x 100 x H₂ pressure/760. For plasma substitute 0.0117 for 0.0146.

95. ARTERIAL BLOOD GASES, O₂ AND CO₂, AT ALTITUDE: MAN

"Ascent" in a Low Pressure Chamber
For a Period Not Longer Than One Hour

Altitude ¹	Arterial Blood Oxygen				Arterial Blood Carbon Dioxide	
	Tension ² mm Hg	Content ² ml/100 ml	Saturation ² %	Tension ² mm Hg	Content ² ml/100 ml	
(A)	(B)	(C)	(D)	(E)	(F)	(G)
1 Sea Level	94	21.1	98	41	49	
2 760 mm Hg						
3 3066 ft						
4 1534 m	66	19.6	91 87-95b	36.5		
5 632 mm Hg						
6 2000 ft	60	19.1	89 86.5-93.5b	37.4		
7 2458 m						
8 864 mm Hg						
9 10000 ft	53	18.4	85.6 79-92b	35.8		
10 3048 m						
11 523 mm Hg						
12 12000 ft	52	18.3	86.9 77-92.5b	34.8		
13 3658 m						
14 485 mm Hg						
15 14000 ft	46	17.0	79.2 71-87.5b	35.4		
16 4267 m						
17 445 mm Hg						
18 14000 ft	41	16.4	74.2 65-87.5b	33.8		
19 4877 m						
20 412 mm Hg						
21 12000 ft						
22 3486 m	36	13.3	71.2 57-85.5b	31.8		
23 379 mm Hg						
24 20000 ft	35	15.2	70.3 57.5-84b	29.4		
25 6096 m						
26 334 mm Hg						

A uniform O₂ capacity of 21.5 ml/100ml and therefore a uniform Hb content of 15.6 g/100ml are assumed.

"Ascent" in a Low Pressure Chamber
For a Period Not Longer Than One Hour

Altitude ¹	Arterial Blood Oxygen				Arterial Blood Carbon Dioxide	
	Tension ² mm Hg	Content ² ml/100 ml	Saturation ² %	Tension ² mm Hg	Content ² ml/100 ml	
(A)	(B)	(C)	(D)	(E)	(F)	(G)
1 Sea Level		19.8	92 84-100b			
2 760 mm Hg						
3 3066 ft	74	20.2	94	40.6	46.3	
4 1534 m						
5 632 mm Hg						
6 2000 ft	57	19.1	88.7	39.6	50.0	
7 2458 m						
8 864 mm Hg						
9 10000 ft	55	18.9	86.1 81-95b	35 26-44b	42.7 35-50b	
10 3048 m						
11 523 mm Hg	54	18.6	86.4 85-88b	38.1	44.8	
12 12000 ft						
13 3658 m	49	17.8	83 71-95b	40 36-44b	47.1 45-50b	
14 485 mm Hg						
15 14000 ft	42	16.9	78.5 65-92b		41.5 31-52b	
16 4267 m						
17 445 mm Hg						
18 12000 ft	36	15.5	72.2 58-86b	23.2	44.9	
19 3486 m						
20 379 mm Hg						
21 20000 ft		14.6	68 55-83b			
22 6096 m						
23 334 mm Hg						

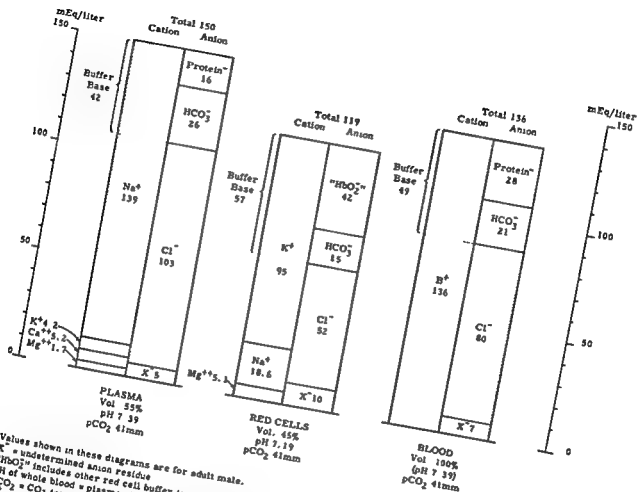
A uniform O₂ capacity of 21.5 ml/100ml and therefore a uniform Hb content of 15.6 g/100ml are assumed.

95. ARTERIAL BLOOD GASES, O₂ AND CO₂, AT ALTITUDE: MAN (Concluded)

Newcomers ^b to Mountainous Regions (Incomplete Acclimatization)									
Permanent Residents in Mountainous Regions (Complete Acclimatization)					Newcomers ^b to Mountainous Regions (Incomplete Acclimatization)				
Altitude ³	Arterial Blood Oxygen				Altitude ³	Arterial Blood Oxygen			
	Tension ¹ mm Hg	Content ² ml/100ml	Capacity ² ml/100ml	Saturation ² %		Tension ¹ mm Hg	Content ² ml/100ml	Capacity ² ml/100ml	Saturation ² %
(A)	(B)	(C)	(D)	(E)	(A)	(B)	(C)	(D)	(E)
492 ft					11319 ft				
14, 150 m	90	20.7	21.7	95.4	46, 3450 m	55	20.5	24.1	85
746-752 mm Hg					496-496 mm Hg				
7840 ft					15421 ft				
35, 2340 m	68	21.2	23.1	91.7	47, 4700 m	44	18.7	24.1	78
36, 468-481 mm Hg		18.5-24b	19-27.5b	86.5-97b	429-429 mm Hg				
10100 ft					17521 ft				
37, 1140 m	66	21.8	24.0	91.0	40, 5340 m	43	18.6	24.5	76.2
58, 817-511 mm Hg		19-25b	22-28b	87-95b	387-401 mm Hg				
12238 ft					20145 ft				
39, 3730 m	57	22.9	25.0	87.6	49, 6140 m	35	16.3	24.9	69.6
40, 479-482 mm Hg		18.5-25b	21.5-28.5b	84.5-91.5b	347-356 mm Hg				
14896 ft									
41, 4540 m	47	23.0	28.3	81.4					
42, 431-448 mm Hg		19.5-26.5b	24-32.5b	75.5-87b					
15950 ft									
43, 4860 m									
44, 413-429 mm Hg	46	23.4	29.0	80.7					
		20.5-26.5b	25-33b	76-85b					
17521 ft									
45, 5340 m	43	23.0	30.2	76.2					
387-401 mm Hg									

/1/ U.S. Standard Atmosphere. /2/ Values are for combined O₂ only, and do not include physically dissolved O₂. /3/ Excepting 1F, values represent alveolar tensions. /4/ 15.8 g Hb/100ml blood ± 1.36 = ml O₂. /5/ Observed altitudes. First barometric pressure is U.S. Standard for observed altitude, second is average observed barometric pressure at time of measurements. /6/ Up to 16 days. Upon exposure of only 3 hours, values in columns C, D, E tend to be lower. In F, G, tend to be higher. /7/ Approximate sea level values for comparison.

96. IONIC BALANCE AND BUFFER BASE, ARTERIAL BLOOD, CELLS AND PLASMA: MAN



Values shown in these diagrams are for adult male.
 X⁻ = undetermined anion residue
 "HbO₂"⁻ includes other red cell buffer ions, such as organic phosphate
 pH of whole blood = plasma pH
 pCO₂ = CO₂ tension.
 B⁺ = mEq total base (Na⁺, K⁺, etc.) in one liter blood, on basis of hematocrit value of 45% red cells.
 Buffer Base = that quantity of total base equivalent in amount (in terms of mEq) to the labile portion of the total anions, i.e., proteinate, bicarbonate, oxyhemoglobinate, organic phosphate and other red cell buffer ions.

95. ARTERIAL BLOOD GASES, O₂ AND CO₂, AT ALTITUDE: MAN (Concluded)

MAN (CONT.)

95. ARTERIAL BLOOD GASES. O₂ AND CO₂. AT ALTITUDE: MAN (CONT.)

Newcomers⁶ to Mountainous Regions
(Incomplete Acclimatization)

Arterial Blood Oxygen

Arterial Blood
Carbon Dioxide

Saturation
%

Capacity²
ml/100ml

Content²
ml/100ml

Tension
mm Hg

Altitude⁵

(A)

(B)

(C)

(D)

(E)

(F)

(G)

(H)

(I)

(J)

(K)

(L)

(M)

(N)

(O)

(P)

(Q)

(R)

(S)

(T)

(U)

(V)

(W)

(X)

(Y)

(Z)

(AA)

(AB)

(AC)

(AD)

(AE)

(AF)

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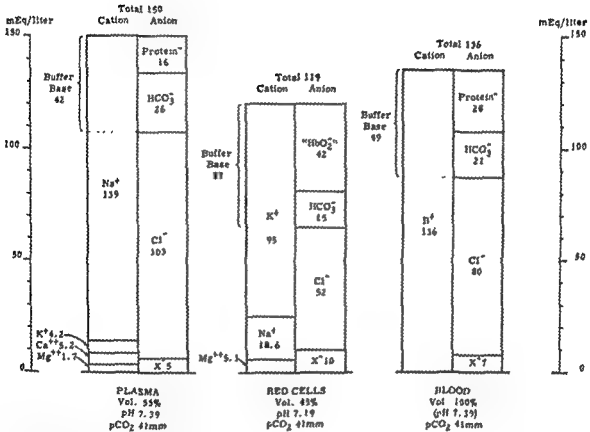
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1/ U. S. Standard Atmosphere. 2/ Values are for combined O₂ only, and do not include physically dissolved O₂. 3/ Excepting 1F, values represent alveolar tensions. 4/ 15.6 g Hg/100ml blood x 1.36 = ml O₂. 5/ Observed altitudes. First barometric pressure is U.S. Standard for observed altitude; second is average observed barometric pressure at time of measurements. 6/ Up to 16 days. Upon exposure of only 2 hours, values in columns C,D,E tend to be lower; in F,G, tend to be higher. 7/ Approximate sea level values for comparison.

96. IONIC BALANCE AND BUFFER BASE, ARTERIAL BLOOD, CELLS AND PLASMA: MAN



Values shown in these diagrams are for adult male

X⁻ = undetermined anion residue.

"HbO₂⁻" includes other red cell buffer ions, such as organic phosphate.

pH of whole blood = plasma pH.

pCO₂ = CO₂ tension

B⁺ = mEq total base (Na⁺, K⁺, etc.) in one liter blood, on basis of hematocrit value of 45% red cells.

Buffer Base = that quantity of total base equivalent in amount (in terms of mEq) to the labile portion of the total anions, i.e., proteinate, bicarbonate, oxyhemoglobinate, organic phosphate and other red cell buffer ions.

98. EFFECTS OF RADIATION ON PERIPHERAL BLOOD

EFFECTS OF RADIATION ON PERIPHERAL BLOOD					
	Type Radiation (A)	Application (B)		Accumulated Dose or Exposure Time (D)	Effects (E)
		(C)			
1	X-ray (200 KVP, 400 KVP, 1000 KVP)	Chronic, total body	15-20 r	40 r	Decreased lymphocytes
2		Chronic, total body	5-10 r/day	300-300 r	
3		Chronic, total body	5-20 r/day	88-300 r	Decreased lymphocytes
4		Chronic, total body		7 dose. Pre- sumably greater than 0.1 r/day	Decreased lymphocytes, neutrophils, WBC, RBC, Hb, increased monocytes
5	High energy gamma	Chronic, total body	0.2 r/week	77 weeks	Increased incidence of leukemia
6	200 KVP x-ray	Dog			Decreased WBC, absolute lymphocytes, absolute neutrophils
7		Acute, total body	20 r		Decreased absolute lymphocytes
8		Acute, total body	50 r		
9	X-ray (250 KVP, 1000 KVP)	Acute, total body	200 r		Decreased absolute lymphocytes
10		Chronic, total body	0.5 r/day 6 days/week	2 years	Decreased: absolute lymphocytes platelets, WBC, granulocytes, reticulocytes
11	X-ray (250 KVP, 1000 KVP)	Chronic, total body	1.0 r/day 6 days/week	1- year	Decreased lymphocytes
12		Chronic, total body	3 r/day 6 days/week	1-2 mo.	Decreased lymphocytes, WBC, neutrophils
13	X-ray (200 KVP)	Chronic, total body	6 r/day 6 days/week	1-2 mo	Decreased absolute lymphocytes, reti- culocytes, platelets
14		Chronic, total body	10 r/day 6 days/week	1 month	Decreased WBC, absolute, lympho- cytes, absolute neutrophils, platelets
15	Fast neutrons	Chronic, total body	12.5 r/day	1262 r	Decreased absolute lymphocytes, absolute neutrophils, WBC, RBC, Hb, reticulocytes
16		Chronic, total body	17 n/day 6 days/week	1 year	Aplastic anemia
17	X-ray (200 KVP)	Chronic, total body	17 n/day 6 days/week	3-4 weeks	Decreased WBC, absolute lympho- cytes, absolute neutrophils, platelets, RBC
18		Chronic, total body	300 r		Decreased WBC, absolute lympho- cytes, absolute neutrophils
		Goat			Decreased lymphocytes, neutrophils, WBC, RBC, Hb.

98. EFFECTS OF RADIATION ON PERIPHERAL BLOOD (Continued)

Type Radiation	Application		Accumulated Dose or Exposure Time	Effects	
(A)	(B)	(C)	(D)	(E)	
Guinea pig					
18	Gamma (radium)	Chronic, total body	0.11 r/day	approx. 1 mo.	Decreased: lymphocytes, WBC, heterophils
19		Chronic, total body	1.1 r/day	approx. 1 mo.	Decreased: lymphocytes, WBC, heterophils
20		Chronic, total body	1.1 r/day	approx. 1 year	Decreased: lymphocytes, WBC, heterophils, (platelets, in females only)
21		Chronic, total body	2.2 r/day	approx. 1 mo.	Decreased: lymphocytes, WBC, heterophils
22		Chronic, total body	2.2 r/day	approx. 1 year	Decreased: lymphocytes, WBC, heterophils, platelets
23		Chronic, total body	2.2 r/day	78 weeks	Decreased: lymphocytes, WBC, heterophils, (RBC, Hb, males only)
24		Chronic, total body	4.4 r/day	approx. 1 mo.	Decreased: lymphocytes, WBC, heterophils
25		Chronic, total body	4.4 r/day	approx. 1 year	Decreased: lymphocytes, WBC, heterophils, platelets, RBC, Hb.
26		Chronic, total body	8.8 r/day	10 days	Decreased: lymphocytes, WBC
27		Chronic, total body	8.8 r/day	approx. 1 mo	Decreased: lymphocytes, WBC, heterophils, platelets
28		Chronic, total body	8.8 r/day	19 weeks	Decreased: lymphocytes, WBC, heterophils, RBC, Hb.
Mouse					
29	X-ray (200 KVP)	Acute, total body	50 r		Decreased: lymphocytes, WBC
30	X-ray (185 KV)	Acute, total body	400 m		Decreased: lymphocytes, WBC, granulocytes, reticulocytes, RBC, Hb.
31	Fast neutrons (cyclotron)	Chronic, total body	0.07 n/day 3 days/week	30 n	Decreased: WBC
32		Chronic, total body	1.4 n/day 5 days/week	230 n	Decreased: absolute lymphocytes, WBC, RBC, Hb.
33					Increased: frequency of WBC below 15,000/mm ³
34					Shift to left present in heterophils
35	Gamma (radium)	Chronic, total body	2.2 r/day	29 weeks	Decreased WBC, absolute lymphocytes
36		Chronic, total body	4.4 r/day	29 weeks	Decreased WBC, absolute lymphocytes
37		Chronic, total body	4.4 r/day	78 weeks	Decreased: WBC, absolute lymphocytes, (RBC, Hb, platelets, males only)
38		Chronic, total body	8.8 r/day	29 weeks	Decreased: WBC, absolute lymphocytes
39		Chronic, total body	8.8 r/day	29 weeks	Decreased: WBC, absolute lymphocytes, RBC, Hb, platelets

98. EFFECTS OF RADIATION ON PERIPHERAL BLOOD (Continued)

EFFECTS OF RADIATION ON PERIPHERAL BLOOD (Continued)					
Type Radiation (A)	Application (B)		Accumulated Dose or Exposure Time (D)	Effects (E)	
		(C)			
			Rabbit		
40		Achie, total body	25 r		
41	X-ray (9200 KVP)	Acute, total body	100 r		Decreased: absolute lymphocytes
42		Acute, total body	500 r		Decreased: absolute lymphocytes, WBC, platelets, reticulocytes, granulocytes
43		Chronic, total body	10 r/day 8 days/week	60-120 r	Decreased absolute lymphocytes, WBC platelets, reticulocytes, granulocytes, RBC, Hb.
44	X-ray (250 KVP, 1000 KVP)	Chronic, total body	10 r/day 8 days/week	720-960 r	Decreased absolute lymphocytes, absolute neutrophils, WBC
45		Chronic, total body	1.7 n/day 8 days/week	15-45 n	Decreased WBC, absolute lymphocytes, absolute neutrophils, RBC, platelets
46	Fast neutrons (cyclotron)	Chronic, total body	1.7 n/day 8 days/week	50-75 n	Decreased absolute lymphocytes, WBC
47		Chronic, total body	1.7 n/day 8 days/week	325 n	Decreased absolute lymphocytes, absolute neutrophils, WBC
48		Acute, total body	9 n		Decreased absolute lymphocytes and heterophils
49	Fast neutrons (pile)	Acute, total body	26 n		Decreased absolute lymphocytes and heterophils
50		Acute, total body	68-76 n		Decreased absolute lymphocytes, heterophils, and platelets
51		Chronic total body	1.1 r/day	approx 2 mos	Decreased absolute lymphocytes, heterophils, platelets, RBC, Hb
52		Chronic, total body	2.2 r/day	approx 2 mos	Decreased absolute lymphocytes
53		Chronic, total body	2.2 r/day	approx 9 mos	Decreased absolute lymphocytes
54		Chronic total body	4.4 r/day	approx 2 mos	Decreased absolute lymphocytes, platelets
55	Gamma (radium) (females only)	Chronic, total body	4.4 r/day	approx 9 mos	Decreased absolute lymphocytes
56		Chronic, total body	8.8 r/day	approx 2 mos	Decreased absolute lymphocytes, platelets
57		Chronic, total body	8.8 r/day	approx 9 mos	Decreased absolute lymphocytes, platelets
58					

98. EFFECTS OF RADIATION ON PERIPHERAL BLOOD (Concluded)

Type Radiation	Application		Accumulated Dose or Exposure Time	Effects
(A)	(B)	(C)	(D)	(E)
Rat				
59 250 KVP X-ray	Acute, total body	5 r		Decreased: absolute lymphocytes
60	Acute, total body	10 r		Decreased: absolute lymphocytes, WBC
61	Acute, total body	50 r		Decreased: neutrophils, WBC, absolute lymphocytes, reticulocytes
62	Acute, total body	100 r		Decreased absolute lymphocytes, neutrophils, WBC, reticulocytes, platelets
63	Acute, total body	300 r		Decreased absolute lymphocytes, neutrophils, WBC, reticulocytes, platelets, RBC, Hb
64 X-ray (250-1000 KVP)	Chronic, total body	0.5 r/day	2 years	Decreased absolute lymphocytes
65	Chronic, total body	1 r/day	1 year	Decreased absolute lymphocytes
66 Fast neutrons	Chronic, total body	1.7 n/day 5 days/week	1 mo.	Decreased absolute lymphocytes
67	Chronic, total body	1.7 n/day 5 days/week	1 year	Decreased absolute lymphocytes, RBC, Hb.
Chick				
68 X-ray (85 KV)	Acute, total body	360 r		Decreased lymphocytes
69 X-ray (200 KVP)	Acute, total body	600 r		Decreased lymphocytes, WBC, heterophils, thrombocytes, RBC, Hb, reticulocytes
Salmon				
70 X-ray (200 KV)	Acute, total body	750 r		Decreased nucleated cells in peripheral blood

99. EFFECTS OF RADIATION ON HEMATOPOIETIC TISSUES

EXPERIMENTAL DATA ON HEMATOPOIETIC TISSUES						
Radiation	Dose and Application	Tissue	Main Histological Effect	Time Post-Exposure When First Observed ¹	Time Post-Exposure When Definite Recovery Began ¹	
(A)	(B)	(C)	(D)	(E)	(F)	
Man						
X-ray (150-175 KV)	100 r, Acute, localized (therapeutic irradiation single dose)	Sternal marrow	Decreased erythro-blasts	2 days	complete by one month	
	200 r, Acute, localized (therapeutic irradiation single dose)	Sternal marrow	Decreased cells	3 days	complete by one month	
			Decreased erythro-blasts	2 days	----	
	300 r, Acute, localized (therapeutic irradiation single dose)	Sternal marrow	Decreased cells	2 days	----	
			Decreased erythro-blast mitosis	2 days	4 days	
	3000 r, Acute, localized (therapeutic irradiation single dose)	Sternal marrow	Decreased mitosis	1 day	1-2 months	
			Decreased erythroid cells	1 day	1-2 months	
	3000 r, Acute, localized (therapeutic irradiation single dose)	Sternal marrow	Decreased cells	1 day	1-2 months	
			Transient aplasia	----	----	
	3000 r, or more, Acute, localized (therapeutic irradiation single dose)	Sternal marrow	Permanent aplasia	----	----	
Dog						
X-ray (250 KVP)	300 r, Acute, total body	Bone marrow	Decreased cellularity	As early as 2 days post-radiation	24-28 days	
			Decreased cells	2 days	24 days	
			Decreased erythroid cells	2 days	4 days	
			Reversed myeloid-erythroid ratio	7-9 days	40 days	
Guinea pig						
X-ray (300 KVP)	175 r, Acute, total body	Lymph node	Increased debris	3 hrs	24 hrs.	
			Slight decreased cellularity	3-8 hrs	by 4 days	
			Increased heterophils	3 hrs	48 hrs	

¹/ Time represents an approximation The figures given have been determined, in large part, by frequency of sampling.

1/ Time represents an approximation The figures given have been determined, in large part, by frequency of sampling.

99. EFFECTS OF RADIATION ON HEMATOPOIETIC TISSUES (Continued)

	Radiation	Dose and Application	Tissue	Main Histological Effect	Time Post-Exposure When First Observed ¹	Time Post-Exposure When Definite Recovery Began ¹
	(A)	(B)	(C)	(D)	(E)	(F)
	Mouse					
18	X-ray (300 KVP)	80 r, Acute, total body	Bone marrow	Increased myeloid cells	8 hrs.	----
19				Increased myeloblasts	12 hrs.	----
20		350 r, Acute, total body	Bone marrow	Increased debris	3 hrs.	5 days
21				Decreased erythropoiesis	3 hrs.	5-8 days
22				Decreased myelopoiesis	3 hrs.	5 days
23	X-ray (188 KV)	400 r, Acute, total body	Bone marrow	Decreased lymphocytes	1 day	----
24				Decreased normoblasts	1 day	7 days
25				Decreased cellularity	1 day	7 days
26				Decreased myelopoiesis	2 days	7-14 days
27				Shift to left present in myelocytic series	10 days	----
28	Fast neutrons (pile)	117 n, Acute, total body	Bone marrow	Cell death	3 hrs.	----
29				Decreased cellularity	3 hrs.	5-8 days
30				Increased debris	3 hrs.	----
31				Cytological damage, megakaryocytes	1 day	---- ²
32				Increased spindle cells	2 days	---- ²
33	X-ray (200 KVP)	50 r, Acute, total body	Lymph nodes and spleen	Increased debris	3 hrs.	----
34				Occurrence of giant cells	4 hrs.	----
35				Increased debris in follicles	4 hrs.	----
36	X-ray (200 KVP)	50 r, Acute, total body	Lymph nodes and spleen	Necrotic foci in germinal follicles	8-12 hrs	----
37						

/1/ Time represents an approximation. The figures given have been determined, in large part, by frequency of sampling.
 /2/ Not recovering at time last sample studied.

99. EFFECTS OF RADIATION ON HEMATOPOIETIC TISSUES (Continued)

ISSUES (Continued)											
		(A)	(B)	(C)	Tissue	Main Histological Effect	Time Post-Exposure When First Observed ¹	Time Post-Exposure When Definite Recovery Began ¹			
		(D)								(E)	(F)
Mouse (Continued)											
38	X-ray (186 KV)	400 r, Acute, total body	Lymph nodes			Decreased cellularity	2-3 hrs.	4 days			
39						Increased debris	2-3 hrs	----			
40						Cytological damage	2-3 hrs.	4 days			
41						Disappearance of secondary nodules	48 hrs.	7-14 days			
42	Fast neutrons (pile)	96 n, Acute, total body	Lymph nodes			Increased extra-medullary myelopoiesis	3-4 weeks	----	2		
43						Complete destruction of nodules	1/2 hr.	3-8 days			
44	X-ray (186 KV)	400 r, Acute, total body	Spleen			Decreased mitosis	2-3 hrs	7-10 days			
45						Cytological damage, lymphocytes	2-3 hrs.	7-10 days			
46						Increased. debris	2-3 hrs	7-10 days			
47						Decreased erythro-	2-3 hrs.	7-10 days			
48						Decreased poiesis	2-3 hrs.	7-10 days			
49						Decreased mega-	2-3 hrs	10-14 days			
50						Increased extramedullary myelopoiesis	10 days	----	2		
Rabbit											
51	X-ray (200 KVP)	100 r, Acute, total body	Bone marrow			Decreased mitosis	Almost immediately after exposure	3 hrs.			
52		400 r, Acute, total body	Bone marrow			Abnormal mitosis	8 hrs.	14 hrs			
53						Decreased mitosis	3 hrs	----			
54						Decreased erythro-	3 hrs	14 days			
55						Decreased poiesis	3 hrs	14 days			
56		800 r, Acute total body	Bone marrow			Increased granulopoiesis	1 day	before 14 days			
57						Increased debris	3 hrs	----			
58						Cessation of mitosis	1/2 hr.	10 days			
59						Decreased erythro-	1/2 hr	10-14 days			
						Increased poiesis	3 hrs	----			
					Decreased myelo-	1 day	14 days				

1/1 Time represents an approximation. The figures given have been determined, in large part, by 5.

2/2 Not recovering at time last sample studied

^{1/1} Time represents an approximation. The figures given have been determined, in large part, by frequency of sampling
^{2/2} Not recovering at time last sample studied

99. EFFECTS OF RADIATION ON HEMATOPOIETIC TISSUES (Continued)

Radiation	Dose and Application	Tissue	Main Histological Effect	Time Post-Exposure When First Observed ¹	Time Post-Exposure When Definite Recovery Began ¹
(A)	(B)	(C)	(D)	(E)	(F)
Rabbit (Cont'd)					
60	X-ray (200 KVP)	800 r, Acute, total body	Bone marrow	Decreased. megalo-blasts	2 days
61		60 r, Acute, total body	Lymph nodes	Increased. debris	3 hrs.
62		100 r, Acute, total body	Lymph nodes	Increased. debris	3 hrs.
63	X-ray (200 KVP)	400 r, Acute, total body	Lymph nodes	Increased: debris	within 3 hrs.
64				Decreased. cellu-larity of nodules	3 hrs.
65				Infiltration with heterophils	1st day
66				Decreased: mitosis	3 hrs.
67	X-ray (200 KVP)	800 r, Acute, total body	Lymph nodes	Shift to left in lymphocytes	8-16 hrs.
68				Decreased: mitosis	30 min.
69				Destruction of lym-phocytes	30 min.
70				Disappearance of nodules	17-24 hrs
71				Increased debris	30 min.
72				Increased spindle cells	24 hrs.
73	X-ray (200 KVP)	25 r, Acute, total body	Spleen	Increased plasma cells	9 days
74				Increased debris	1 day
75				Cytological damage	1 day
76				Decreased mitosis	1 day
77	X-ray (200 KVP)	50 r, Acute, total body	Spleen	Cytological damage	1 day
78				Cessation of mitosis	1 hr.
79				Increased debris	1 hr.
80				Cytological damage	1 hr.
81	X-ray (200 KVP)	600 r, Acute, total body	Spleen	Decreased cellu-larity	8 hrs.
				Decreased cellu-larity	8 hrs.

^{1/} Time represents an approximation. The figures given have been determined, in large part, by frequency of sampling.

99. EFFECTS OF RADIATION ON HEMATOPOIETIC TISSUES (Continued)

RADIATION ON HEMATOPOIETIC TISSUES (Continued)						
	Radiation (A)	Dose and Application (B)	Tissue (C)	Main Histological Effect (D)	Time Post-Exposure When First Observed (E)	Time Post-Exposure When Definite Recovery Began (F)
	Rabbit (Cont'd)					
82	X-ray (200 KVP)	800 r, Acute, total body	Spleen	Decreased size	1 day	----
83				Cessation of mitosis	1/2 hr.	8 hrs.
84				Cytological damage (lymphocytes)	1/2 hr.	----
85				Increased debris	1/2 hr.	8 hrs.
86				Destruction of lymphocytes	3 hrs.	8 days
87				Decreased cellularity	3 hrs.	9 days
88				Increased plasma cells	8 days	----
89				Decreased erythroblasts	24 hrs.	14 da-
90				Decreased myelocytes	2 days	14 days
	Rat					
91	X-ray (200 KVP)	400 r, Acute, total body	Lymph nodes	Cytological damage (lymphocytes)	within 16 hrs.	3 days
92	X-ray (200 KVP)	600 r, Acute, total body	Lymph nodes	Degeneration of nodule	within 16 hrs	3 days
93				Cytological damage (lymphocytes)	1/2 hr.	14-1/2 hrs.
94				Degenerative change (nodules)	14-1/2 hrs	21 days
95				Disappearance of nodules	24 hrs.	21 days
96				Infiltration with heterophils	8 hrs	----
97	X-ray (250 KVP)	550 r, Acute, total body	Spleen	Hemorrhage	all periods up to 31 days	---- ²
98				Increased debris	30 min.	8 hrs.
99				Destruction of lymphocytes	2 hrs.	----
100				Disappearance of nodules	30 hrs.	15 days
101				Decreased cellularity	2 hrs	9 days

1/ Time represents an approximation. The figures given have been determined, in large part, by frequency of sampling.

2/ Not recovering at time last sample studied

^{1/} Time represents an approximation. The figures given have been determined, in large part, by frequency of sampling.
^{2/} Not recovering at time last sample studied

99. EFFECTS OF RADIATION ON HEMATOPOIETIC TISSUES (Continued)

Radiation		Dose and Application	Tissue	Main Histological Effect	Time Post-Exposure When First Observed ¹	Time Post-Exposure When Definite Recovery Began ¹
(A)		(B)	(C)	(D)	(E)	(F)
Rat (Continued)						
102	X-ray (200 KVP)	600 r, Acute, total body	Spleen	Decreased megakaryocytes	3 days	3 weeks
103				Cytological damage (erythroblasts)	3 hrs.	----
104				Decreased erythropoiesis	8 hrs.	9 days
105				Destruction of lymphocytes	3 hrs.	----
106				Decreased mitosis	1/2 hr	8 hrs.
107				Decreased cellularity of nodules	3 hrs.	14 days
108	X-ray (200 KVP)	550 r, Acute, total body	Marrow	Decreased lymphocytes	15 min.	III days
109				Decreased megakaryocytes	3 hours	14 days
110				Decreased myeloid cells	30-45 hrs.	14 days
111				Decreased erythroid cells	6-15 hrs.	5 days
112	X-ray (200 KVP)	600 r, Acute, total body	Marrow	Increased debris	3 hrs.	----
113				Decreased erythropoiesis	3 hrs.	9 days
114				Decreased myelopoiesis	2 days	31 days
115	Fast neutrons (cyclotron)	56 4 n		Decreased megakaryocytes, granulocytes, erythroid cells, cellularity, mitosis	----	15 days
Chick						
116	X-ray (200 KVP)	200 r, Acute, total body	Bone marrow	Cytological damage (lymphocytes)	----	----
117		100 r, Acute, total body	Bone marrow	Decreased mitosis, cellularity	30 min 13 hrs	2 hrs. III days
118		400 r, Acute, total body	Bone marrow	Decreased lymphocytes	7 hrs.	13-48 hrs.
119				Decreased myelocytes	7 hrs.	13-48 hrs.
120				Decreased erythroblasts	7 hrs.	13-48 hrs.

/1/ Time represents an approximation. The figures given have been determined, in large part, by frequency of sampling.

99. EFFECTS OF RADIATION ON HEMATOPOIETIC TISSUES (Concluded)

	Radiation	Dose and Application	Tissue	Main Histological Effect	Time Post-Exposure When First Observed ¹	Time Post-Exposure When Definite Recovery Began ²
	(A)	(B)	(C)	(D)	(E)	(F)
	Chick (Continued)					
121	X-ray (200 KVP) (Continued)	800 r, Acute, total body	Bone marrow	Decreased mitosis	45 min.	---- ²
122				Erythropoiesis abolished	1 hr.	2-4 days
123				Erythroblasts destroyed	1 hr.	3-4 days
124				Small lymphocytes destroyed	1-3 hrs.	---- ²
125				Increased debris	1-2 hrs	----
126				Granulocytopoiesis destroyed	14 hrs.	---- ²
127	X-ray (200 KVP)	25 r, Acute, total body	Spleen	Cytological damage (lymphocytes)	----	----
128		100 r, Acute, total body	Spleen	Debris and dead lymphocytes	1/2 hr.	18 hrs.
129		400 r, Acute, total body	Spleen	Decreased mitotic activity	1/2 hr	7 hrs.
130				Destruction of small lymphocytes	1/2 hr.	3 days
131		800 r, Acute, total body	Spleen	3/4 of small lymphocytes killed	4 hrs	3-5 days
132				Cessation of mitosis	45 min.	5 hrs.
133				Destruction of lymphocytes	45 min	9 days
134				Increased hemocytoblasts	45 min.	1-3 days
135			Increased plasma cells	2 hrs	----	
	Salmon					
136	X-ray (200 KVP)	500 r, Acute, total body	Kidney	Decreased hematopoietic cells in hematopoietic tissue	----	----

^{1/1} Time represents an approximation. The figures given have been determined, in large part, by frequency of sampling.
^{2/2} Not recovering at time last sample studied.

100. CHANGES IN STORED PRESERVED BLOOD

Variable	Preservative ²	Period of Storage																	
		0 days			10 days			20 days			30 days			40 days					
		Blood	RBC	Plasma	Blood	RBC	Plasma	Blood	RBC	Plasma	Blood	RBC	Plasma	Blood	RBC	Plasma			
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)	(P)	(Q)			
1																			
2	pH ³	C	7.4			7.1			7.1										
3		CD	7.4			7.1			6.8			6.7			6.7				
4		ACD	7.1			6.7			6.6			6.6			6.5				
5	Potassium	C		100	5		75	23		63	32								
6	(mEq/1000 ml)	CD		100	5		74	20		68	25		60	28		53	34		
7		ACD		90	5		75	12		68	19		60	23		53	27		
8	Sodium	C		25	166		45	149		35	142								
9	(mEq/1000 ml)	CD		21	158		40	148		30	148		52	142		58	138		
10		ACD		18	160		25	152		30	148		37	142		42	137		
11	Inorganic Phosphorus	C		0	0		35	7		35	10		29	10		28	12		
12	(mg/100 ml)	CD		0	2		10	3		28	6		25	9		25	10		
13		ACD		5	2		18	5		25	8								
14	Adenosine Tri-phosphate	C		15			5			2			2			2			
15	(mg/100 ml)	CD		15			9			5						6			
16		ACD		15			14			12			9						
17	Lactic acid ⁴	C																	
18	(mg/100 ml)	CD	20			80													
19		ACD	10			135													
20		ACD	20			90													
21	Glucose ⁵	C																	
22	(mg/100 ml)	CD	70		106				106						170				
23		ACD	7207		650?				575?										
24		ACD	6708		600?				550?										

/1/ Whole preserved (C, CD, and ACD) human blood kept at 4°C and analyzed within 20 minutes after removal from storage. /2/ Preservative C: 3 g trisodium citrate-d₂H₂O, in 100 ml aqueous solution, pH 7.5 (effective tonicity re blood = 141%). Ten ml added to 100 ml blood, increasing blood citrate by 10 mM/liter, and plasma citrate by 17 mM/liter. Preservative CD: 2.13 g trisodium citrate-d₂H₂O, plus 5 g glucose anhydrous, in 100 ml aqueous solution, pH 7.5 (effective tonicity re blood = 94%). Fifteen ml added to 100 ml blood, increasing blood citrate by 11 mM/liter, and plasma citrate by 19 mM/liter, blood glucose by 650 mg/100 ml. Preservative ACD: 1.33 g trisodium citrate-d₂H₂O, plus 470 mg citric acid, and plasma glucose anhydrous, in 100 ml aqueous solution, pH 5.03 (effective tonicity re blood = 64%). Twenty-five ml added to 100 ml blood, increasing blood citrate by 13 mM/liter, plasma citrate by 21 mM/liter, blood glucose 600 mg/100 ml, citric acid by 16.5 mEq/liter. Blood changes in 8 days with C equivalent to 16 days with CD equivalent to 33 days with ACD. /3/ pH measured at 37.5°C. Blood and plasma, same pH. /4/ Determined by modified aeration-titration method of Friedman. /5/ Determined by Nelson modification of Somogyi method. /6/ Residual non-fermentable reducing substances. /7/ Normal blood glucose plus glucose in CD. /8/ Normal blood glucose plus glucose in ACD.

100. CHANGES IN STORED PRESERVED BLOOD (Concluded)

Variable	Preservative	Period of Storage											
		0 days				10 days				20 days			
		Blood	RBC	Plasma	Blood	RBC	Plasma	Blood	Plasma	RBC	Plasma	Blood	Plasma
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)
22 Glycolysis Rate ⁹	C	50				1010							
23 (mg glucose/100 ml RBC/hr)													
24 (mg lactic acid/100 ml RBC/hr)	CD	40.11	17.11										
25 ACD													
26 Diam. Thick.	C	7.89	17.11			20.11							
27 Dimensions of RBC's													
28 Diam. Thick.	CD	1.80				6.92							
29 ACD						2.32							
30 Diam. Thick.	CD	7.90	2.08			7.33							
31 ACD						2.30							
32 Diam. Thick.	CD	7.42				7.33							
33 ACD						2.38							
34 Diam. Thick.	C	0											
35 ACD													
36 Diam. Thick.	C	0				2.3							
37 ACD						7.3							
38 Hemolysis ¹¹													
39 (Per cent of RBC hemolysed)	CD	0				60							
40 ACD													
41 Diam. Thick.	CD	0				0							
42 ACD						0							
43 Diam. Thick.	CD	0				0							
44 ACD						0							
45 Diam. Thick.	CD	0				0							
46 Hemoglobin in Plasma (mg/100 ml)	C14	1				11.1							
47 ACD													
48 Diam. Thick.	CD	0				0							
49 ACD						0							
50 Diam. Thick.	CD	0				0							
51 ACD						0							
52 Diam. Thick.	CD	0				0							
53 ACD						0							
54 Diam. Thick.	CD	0				0							
55 ACD						0							
56 Diam. Thick.	CD	0				0							
57 ACD						0							
58 Diam. Thick.	CD	0				0							
59 ACD						0							
60 Diam. Thick.	CD	0				0							
61 ACD						0							
62 Diam. Thick.	CD	0				0							
63 ACD						0							
64 Diam. Thick.	CD	0				0							
65 ACD						0							
66 Diam. Thick.	CD	0				0							
67 ACD						0							
68 Diam. Thick.	CD	0				0							
69 ACD						0							
70 Diam. Thick.	CD	0				0							
71 ACD						0							
72 Diam. Thick.	CD	0				0							
73 ACD						0							
74 Diam. Thick.	CD	0				0							
75 ACD						0							
76 Diam. Thick.	CD	0				0							
77 ACD						0							
78 Diam. Thick.	CD	0				0							
79 ACD						0							
80 Diam. Thick.	CD	0				0							
81 ACD						0							
82 Diam. Thick.	CD	0				0							
83 ACD						0							
84 Diam. Thick.	CD	0				0							
85 ACD						0							
86 Diam. Thick.	CD	0				0							
87 ACD						0							
88 Diam. Thick.	CD	0				0							
89 ACD						0							
90 Diam. Thick.	CD	0				0							
91 ACD						0							
92 Diam. Thick.	CD	0				0							
93 ACD						0							
94 Diam. Thick.	CD	0				0							
95 ACD						0							
96 Diam. Thick.	CD	0				0							
97 ACD						0							
98 Diam. Thick.	CD	0				0							
99 ACD						0							
100 Diam. Thick.	CD	0				0							

⁹ RBC incubated 90 minutes at 37°C. measured lactic acid produced and glucose lost. ¹⁰ Glycolysis measured by breakdown of added glucose as glucose originally present has disappeared. see Fp 5. ¹¹ Glycolysis involves breakdown of added glucose. see Fp 7, 8. ¹² Mean Corpuscular Volume (M. C. V.) = Hematocrit/RBC count per mm³ blood. Hematocrit determined by method of Guess and Siler. Mean diameter read from stained film covered with 0.5% NaCl. Mean Thickness = M. C. V./M. C. V. ¹³ Determined colorimetrically ¹⁴ % sodium citrate.

101. EFFECTIVE BLOOD LEVELS OF THERAPEUTIC AGENTS

Therapeutic Agent	Therapeutic Use	Dosage	Method of Admin.	Time after Admin.	Blood	Plasma	Serum	RBC
					mg/100ml	mg/100ml	mg/100ml	mg/100ml
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)
I. Aliphatic Narcotics								
1 Amytal, pentobarbital and secobarbital	Sedation and hypnosis	100-250 mg	Oral	1 hr	<1			
2 Barbitol	Sedation and hypnosis	16-20 mg/kg/day	Oral	1-24 hr	5 12 ¹ 15-20			
3 Chloroform	Surgical anesthesia	1.5 vol. % in inspired air	Inhalation	About 5 min				
4 Cyclopropane	Surgical anesthesia	20-30 vol. % in inspired air	Inhalation	2-3 min	15			
5 Ethyl alcohol	Euphoria	About 30 ml 50% alcohol	Oral	15-30 min	30			
6	Hypnotic	About 100 ml, 50% alcohol	Oral	15-30 min	100			
7	Anesthetic (stupor)	About 300-400 ml 50% alcohol	Oral	15-30 min	300-400			
8	Generally fatal	Adults: 1000 ml, Children: 100-200 ml	Oral	5-100 hr	500			
9 Ethyl chloride	Surgical anesthesia	50% alcohol 3-4.5 vol. % in inspired air	Inhalation	2 min	20-30			
10 Ethylene	1st plane anesthesia	80-85 vol. % in inspired air	Inhalation	20 min	120-180			
11 Ethyl ether	Surgical anesthesia	6-10 vol. % in inspired air	Inhalation	15-25 min	50-130			
12 Methyl N-propyl ether (Metopryl)	Surgical anesthesia	2.3-3 vol. % in inspired air	Inhalation	10-15 min	30-60			
13 Nitrous oxide (Nitrogen monoxide)	1st plane anesthesia	85-92 vol. % in inspired air	Inhalation	2 min	23 vol. %			
14 Paraldehyde	Obstetrical amnesia and analgesia	30 ml in 60 ml olive oil	Rectal or nasal	0.5-16 hr ²		11.6-24.4		
15 Phenobarbital	Sedation and hypnosis	5-10 mg/kg/day	Oral	1-24 hr	5 or less ³			
16 Thiopental sodium (Sodium pentothal)	1st & 2nd plane anesthesia	35 mg/kg/hr	Intravenous	Immediate				
17 Tribromethanol (Avertin)	Basal anesthesia	80-100 mg/kg	Rectal	30 min	8-9			
18 Vinyl Ether (Divinyl oxide, "vineethene")	Surgical anesthesia	4 vol. % in inspired air	Inhalation	1-2 min	30-40			
II. Bromides								
19 Sodium bromide or other alkaline bromides	Sedation	2-3 g/day	Oral	1 hr or more	16-50			
20	Antiepileptic	3-10 g/day	Oral	Several days				
III. Analgesics								
21 Isonipacaine (Demerol)	Analgesic	100 mg	Intramuscular	1.5-2 hr	0.125 in 0.5 hr and 0.05 after 2 hr			

1/ May produce unconsciousness 2/ Peak level 2-4 hr. 3/ Blood level over 7 mg/100 ml indicates overdosage.
 4/ Bromoderma and other symptoms observed.

101. EFFECTIVE BLOOD LEVELS OF THERAPEUTIC AGENTS (Continued)

Therapeutic Agent	Therapeutic Use	Dosage	Method of Admin.	Time after Admin.	Blood	Plasma	Serum	RBC
					mg/100ml	mg/100ml	mg/100ml	mg/100ml
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)
21 Sodium salicylate	Acute rheumatic fever	5-15 g/day	Oral	24 hr or more		8-28	157-558 µg/ml	
IV. Cardiac Drugs								
23 Digoxin	Congestive heart failure	1.2-1.6 mg	Oral	About 6 hr			20 µg/100 ml ⁵	
24 Ouabain	Congestive heart failure	0.5 mg (divided)	Intravenous	About 1-2 hr			5 µg/100 ml ⁵	
25 Potassium acetate	In relation to digitalis glycosides	5 g	Oral	1 hr or more			20-27	
26 Procaine hydrochloride	Abolition of cardiac arrhythmias	200 mg	Intravenous	25 min	0.055-0.060			
27 Quinidine sulfate	Control of various cardiac arrhythmias	0.8 g	Oral	2-10 hr		8.68-0.27 ⁶		
V. Hypotensive Agents								
28 Potassium thiocyanate	Hypertension	0.5 g/day	Oral	1-3 hr		8-10		
VI. Skeletal Muscle Relaxants								
29 Myonasin or 3-(3'-Methylphenoxy)propane-1, 2-diol (spinal cord depressant)	Adjuvant to anesthetics, treatment of convulsive poisonings (particularly strychnine)	50 mg	Intravenous	Immediate		5		
30				20 min later		2.4		
31 d-Tubocurarine chloride (neuromuscular depressant)	Adjuvant to anesthetics, control of shock therapy in schizophrenia	0.2 mg/kg	Intravenous	3 min		0.4		
32				15 min		0.16		
33				30 min		0.1		
VII. Histamine and Antihistamines								
34 beta-Dimethylaminoethyl benzhydriol ether hydrochloride (Benadryl)	Allergic reactions	400 mg	Oral	1-2 hr	0.5-1.6 µg/ml			
35 Histamine phosphate	Stimulation of hydrochloric acid secretion	2 mg	Subcutaneous	30 min	>7.5 µg/100 ml			
36 Pyridyl-benzyl-dimethyl-ethylene diamine hydrochloride (Triptellamide or pyribenzamine)	Allergic reactions	400 mg	Oral	1-3 hr	0.4 µg/ml			
VIII. Anti-anemics								
37 Ferric sodium citrate	Secondary anemia	0.75 g ⁷	Oral	1 hr			0.15	
38				3 hr			0.25	
39				8 hr			28	
40				14 hr			<0.8	

⁵/Calculated, ⁶/8-14 hr 1 g oral 0.2 - 0.43 mg/100 ml plasma ⁷/Insufficient therapeutic dosage.

101. EFFECTIVE BLOOD LEVELS OF THERAPEUTIC AGENTS (Continued)

Therapeutic Agent	Therapeutic Use	Dosage	Method of Admin.	Time after Admin.	Blood	Plasma	Serum	RBC
					mg/100ml	mg/100ml	mg/100ml	mg/100ml
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)
41 Ferrous ammonium sulfate	Secondary anemia	0.75 g ⁷	Oral	Same as (37-40E)			Similar to (37-40 H)	
42 IX, Iodine and Anti-thyroid Substances	Prevention of hypothyroidism	1.5 mg/day	Oral	2-4 wk	7 µg/100 ml			
43 Sodium iodide	Pre-operative treatment of thyrotoxicosis	15 mg/day	Oral	Several days	>19 µg/100 ml ⁸			
44 Thiourea	Thyrotoxicosis	1-2 g	Oral	Variable	3-5			
45 2-Thiouracil	Thyrotoxicosis	0.8 g/day	Oral	Variable		0.3-0.5		
46 X, Calcium Compounds	Calcium deficiency	0.8 g t.i.d. (with vitamin D)	Oral	Several days	8-11			
47 Di-calcium phosphate								
48 XI, Chemotherapeutic Agents								
49 (1) Antibiotics								
47 Aureomycin	Typhoid fever	100 mg	Intramuscular	24 hr	0.03-0.06 µg/ml			
48	Rocky Mountain spotted fever	300 mg	Oral	24 hr	0.03 µg/ml			
49	A. aerogenes, abscess pneumonia, and meningitis	700 mg	Oral	24 hr	0.03-0.1 µg/ml			
50 Chloramphenicol (Chloromycetin)	Typhoid fever	15.5 g in four days	Oral	24 hr or more	20-30 µg/ml			
51 Penicillin	Infection with penicillin-susceptible organisms	100,000 units in 24 hr	Intravenous drip			0.13 units/ml		
52		200,000 units in 24 hr				0.22 units/ml		
53		400,000 units in 24 hr				0.42 units/ml		
54 Penicillin	Respiratory infections	30,000 units every 2-4 hr	Inhalation ⁹	2-3 hr			0.11-0.22 units/ml	
55 Penicillin-aluminum hydroxide	Mild infections	100,000 units	Oral	1-10 hr		0.03-0.3 units/ml		
56 Penicillin (Beeswax-peanut oil mixture)	Usual indications	600,000 units	Intramuscular	12 hr		0.1-1.0 units/ml		
57 Penicillin (Crystalline) without caronamide	Severe infections	1,000,000 units	Rapid intravenous	3 hr		2 units/ml		
58 Penicillin (Crystalline) with caronamide	Severe infections	1,000,000 units	Rapid intravenous	3 hr		10 units/ml		
59 Penicillin (Procaine penicillin G in oil)	Pneumonia	300,000 units	Intramuscular	8 hr		0.34-0.66 units/ml		
60 Streptomycin	Infections with streptomycin-susceptible bacteria	0.15 g every 3 hr	Intramuscular	3 hr	14 µg/ml ¹⁰			

⁷/Insufficient therapeutic dosage. ⁸/Calculated. ⁹/Through nebulizers. ¹⁰/10-20 µg/ml is usually more desirable.

101. EFFECTIVE BLOOD LEVELS OF THERAPEUTIC AGENTS (Continued)

Therapeutic Agent	Therapeutic Use	Dosage	Method of Admin.	Time after Admin.	Blood	Plasma	Serum	RBC
					mg/100ml	mg/100ml	mg/100ml	mg/100ml
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)
61 Terramycin hydrochloride (2) Anti-Malarials	Acute pulmonary infections	750 mg or more	Oral	1-5 hr	0.7-3.0 µg/ml			
62 Chloroquine hydrochloride (Paludrine)	Suppression and termination of attacks during vivax or falciparum infection	50 mg b.i.d., 500 mg b.i.d.	Oral	4 hr		50-100 µg/1000 ml 300-500 µg/1000 ml		
64 Chloroquine diphosphate	Suppression of malaria in man	1.24 g (divided within a day) Priming dose 1.2 g (within 6 hr)	Oral	4 hr		80-160 µg/1000 ml		
65				6-8 hr		280 µg/1000 ml		
66 Pamaquine naphthoate	Gametocidal effect of malaria organisms in man	0.02 g 5 times/day	Oral	1-2 hr		250 µg/1000 ml		
67 Pentaquine monophosphate	Gametocidal effect	50 mg/day	Oral	3 hr		30-50 µg/1000 ml		
68 Quinacrine hydrochloride (Atabrine)	Suppression of malaria in man	0.6 g/wk (divided)	Oral	1 wk			30-50 µg/1000 ml	
69	Suppression of malaria in man	1.6 immediately	Oral	48 hr		81-245 µg/1000 ml ¹¹		
70 Quinacrine	Severe malaria (ante mortem) or gastrointestinal intolerance to quinacrine	1 g	Intravenous	Immediate		8-22		
71 Quinine salts	Human malaria, Class I (De-celerated increase in the parasitemia)	0.5 g once daily	Oral			0.2		
72	Class II (Marked depression of parasitemia with clinical remission)	1-2 g/day	Oral			0.2-0.4		
73	Class III (Complete disappearance of parasitemia, no clinical symptoms)	3 g/day	Oral			0.5-0.7		
(3) Antimony Compounds								
74 Antimonialine (Antimony lithium thio-maleate)	Wuchereria bancrofti infection and kala-azar	0.5 mg of Sb/kg	Intra-muscular	1 hr		0.18 µg/g		0.78 µg/g
75		0.5 mg of Sb/kg	Intra-muscular	24 hr		0.03 µg/g		0.15 µg/g
76 Monosodium antimony thio-glycollate	Same as 74B	0.5 mg of Sb/kg	Intra-muscular	1 hr		0.12 µg/g		1.1 µg/g
77 Neostibosan (Ethylstibamine)	Same as 74B	2.0 mg of Sb/kg (initial) 1.2	Intra-venous	24 hr		0.07 µg/g 0.7-0.9 µg/g		0.35 µg/g 0.2-0.3 µg/g

¹¹¹/Each gram of quinacrine administered by mouth raises the plasma level by 25 µg/1000 ml, and there is a daily decrease of the plasma concentration by 10 per cent. ¹¹²/Total dose: 50-80 mg Sb/kg in 8-10 days.

101. EFFECTIVE BLOOD LEVELS OF THERAPEUTIC AGENTS (Continued)

Therapeutic Agent	Therapeutic Use	Dosage	Method of Admin.	Time after Admin.	Blood	Plasma	Serum	RBC
					mg/100ml	mg/100ml	mg/100ml	mg/100ml
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)
79 Solustibosan (Diethylaminoethanol salt of sodium antimony glyconate) (4) Aromatic Amidines	Same as 74B	3.0 mg of Sb/kg (initial) ¹³	Intravenous	24 hr		0.4 µg/g		0.6 µg/g
80 Stibamidine	Trypanosomiasis, Kala azar, babesiasis, and multiple myeloma		Oral	30 min			40 µg/ml	
81			Subcutaneous	1 hr			20 µg/ml	
(5) Arsenicals								
82 Arsenphenamine	Syphilis (Intensive therapy)	31.7 mg/kg in 5 days i.i.d. 0.067 g/day	Intravenous	4-6 hr	0.5-0.7 mg/100 g			
83 Chlorarsen (Dichlorophenarsine hydrochloride)	Syphilis		Intravenous	15 min		<0.05 ¹⁴		
84 Neocarphenamine	Syphilis	0.1 g	Intravenous	15 min		0.2-0.35 ¹⁴		
85 Oxophenarsine hydrochloride (Mapharsen)	Syphilis	0.08 g	Intravenous	10 min		<0.05 ¹⁵		
86	Syphilis (Intensive therapy)	0.84 g/day	Intravenous	3 days	17 µg/100 ml ¹⁴			
87 Tryparsamide	Neurosyphilis, trypanosoma gambiense infection	2 g	Intravenous	24 hr		0.03-0.04 µg/ml ¹⁴		
(6) Sulfonamides								
88 Sulfadiazine	Same as the other sulfonamides, particularly effective against type II Friedlander bacillus	4 g initially followed by 1 g every 4 hr	Oral	6-12 hr	10-15			
89 Sulfaguanidine	Prophylaxis in colonic surgery, intestinal antisepsis	0.01 g/kg initially, followed by 0.05 g/kg every 4 hr	Oral	Irregular	5			
90 Sulfamerazine	Same as other sulfonamides	3-4 g initially, followed by 1 g every 8 hr	Oral	12-24 hr	10-15			
91 Sulfanilamide	Streptococci, meningococci, pneumococci, staphylococci infections, etc.	30-50 mg/kg in 24 hr ¹⁵	Oral	12-24 hr	10-15			
92 Sulfapyridine	Same as 91 B (seldom used)	5 g	Oral	6-12 hr	4-6			
93 Sulfathiazole	Pneumococci and gonococci infections	4 g initially, followed by 0.5-1 g every 4 hr	Oral	4-8 hr	4-6			

¹³Total dose 71-84 mg Sb/kg in 5 or 9 days. ¹⁴Expressed as arsenic ¹⁵One-third of total dose should be given first day

101. EFFECTIVE BLOOD LEVELS OF THERAPEUTIC AGENTS (Concluded)

Therapeutic Agent	Therapeutic Use	Dosage	Method of Admin.	Time after Admin.	Blood	Plasma	Serum	RBC
					mg/100ml	mg/100ml	mg/100ml	mg/100ml
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)
<u>XII. Miscellaneous Chemotherapeutic Agents</u> 94 Para-aminobenzoic acid 95 p-Chloroxylenol 96 Suramin sodium (Germanin, Bayer 203) 97	Tsetse-gamushi disease Urogenital infections African sleeping sickness	5 g initially followed by 3 g every 2 hr 1-2 g 1 g	Oral Intramuscular Intravenous	12-24 hr 2 hr 48 hr 9 days	100-130 1-3 48 0.6			
<u>XIII. Vitamins</u> 98 Vitamin A 99 Ascorbic acid 100 Biotin 101 Carotene 102 Folic acid 103 Inositol 104 Nicotinic acid 105 Pantothenic acid 106 Riboflavin 107 Tocopherol	Hypovitaminosis A Scurvy; peptic ulcer Hypovitaminosis A (seldom used) Nontropical sprue Amyotrophic lateral sclerosis Clinical pellagra Cheliosis, etc. Habitual abortion, menstrual disorders, etc.	10,000 or more units/day 5 g/day 0.3 mg/day 10-20 mg/day 1.5 g/day Up to 500 mg/day 5-10 mg/day 0.75-8 ml of wheat germ oil/day	Oral Oral Oral Oral Oral Oral	Variable 3 wk Variable	80-130 I.U./100 ml 0.8-1.2 1.2-1.8 µg/100ml 3-5 µg/100 ml 0.8 µg/100 ml 30-45 µg/100 ml 80	100-220 µg/100ml 0.75 1.2 or more		
<u>XIV. Hormones</u> 108 Estrone sulfate (Conjugated estrogens) 109 110 111 112 113 ACTH 114 Thyroxin	Cancer of prostate, etc. Acute rheumatic fever, rheumatoid arthritis Myxedema	100-400 mg ¹⁶ 100-330 mg ¹⁶ 0.3 mg	Intravenous Intravenous	Immediately 2 hr 4 hr 8 hr 24 hr 2 hr Variable	10-100 µg/ml 12-13 µg/100 ml of hormonal iodine	16-40 µg/ml 2-12.4 µg/ml 0-13 µg/ml 0-7.8 µg/ml 0.9 µg/ml		
<u>XV. Antimitotic Agents</u> 115 Urethane	Chronic myeloid leukemia and Hodgkin's disease	1 g 6 times/day	Oral	22 hr	10-35			

BIBLIOGRAPHY

Bibliography

The system for presenting bibliographic references used here has been adapted from one in common use in geographic atlases. An item in a table is identified by two coordinates, a letter designating the column, and a number the row, in which the item appears. In a typical instance in the bibliography, the coordinates of an item are followed, in the column to the right, by a number accompanied by a small letter. The number refers to the bibliographic source, the letter to the person contributing the item. If an item in a table is based on another item from another part of the same table, the coordinates of the latter are given as source, enclosed in parentheses.

This method of presentation of bibliographic references permits identification of both the reference source of each item and the person contributing it, without the necessity of use of reference numbers on the face of the table. The resulting saving in space permits use of a larger type face in each table, with a consequent gain in readability. It is not uncommon for some value in a table to be based on more than a single reference source. The occurrence of such instances has given emphasis to the desirability of eliminating reference numbers from the tables.

Where an item is contributed as general knowledge, or from the unpublished investigations of the contributor, a letter appears in the source column without accompanying number. It should be understood that a person listed as a contributor for any table is not responsible for portions of the table other than as indicated.

The following abbreviations are used: Fn = footnote; Calc. fr. = calculated from; Av. = average.

1. BLOOD SPECIFIC GRAVITY

Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References
Fn 2 1-3 ABCD & Fn 1 1-3 E 4, 3 A-E 6, 7 A-D 6, 7 E 8, 9 A-E* & Fn 3, 4, 5 10, 11 A-E	d, 10 7b 9b 5 8 12 1 5	12, 13 A-D* & Fn 6, 7 12, 13 E 14-19 ABCD* & Fn 8 14-19 E 20 A-D* & Fn 9 21 A-D* & Fn 10 21 E 22-27 ABCD* & Fn 11 22-27 E	3 12 13a 7 6c 2 11 7	28 A-D* 26 E 29, 30 A-E 31 A-D* & Fn 12 31 E 32-36 ABCD* & Fn 13 32-36 E 37 A-E* & Fn 9, 14 38, 39 A-E	2 11 5 11 13a 7 4c 5

*Values in literature converted to standard reference temperature (as indicated in column D) by V P Dole

- Contributors (a) Cronkite, E P (b) Dole, V P (c) Holman, H H (d) Van Slyke, D D
- References (1) Braun, W. Am J Vet Res 1451, 1946 (2) Dougherty, T F. and White, A. Endocrinology 13, 1944 (3) Ederstrom, H E., and DeBoer, B. Anat Rec 95 663, 1946 (4) Holman, H H J Comp Path Therapeut 54 26, 1944 (5) MacLeod, J. Quart J Exp Physiol 22 275 1932 (6) Stewart, J. and Holman, H. H. Ver Rec 52 157, 1940 (7) Van Slyke, D D., Phillips, R A., Dole, V P Hamilton P B. Archibald, R. M., and Plazin, J J Biol Chem 183 349, 1950 (8) Wandie, W F et al Anat Rec 78 321, 1940 (9) Phillips, R A., Van Slyke, D D., Hamilton, P B., Dole, V P., Emerson, K E., Jr., and Archibald, R. M. J Biol Chem 182 305, 1950 (10) Gregersen, M I., and Schiro, H. Am J Physiol 121 284, 1938 (11) Kagan, H M. J Lab Clin Med 26 1680, 1941 (12) Barbour, H G., and Hamilton, W F J Biol Chem 62 625, 1926 (13) Cronkite, E P., unpublished data

2. RELATIVE VISCOSITIES. BLOOD. PLASMA. SERUM

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Fn 1-3 1 A-C 1 D* E*	a 1a, 2a 3a, 4	5, 6 A-C 6 D* E*	7a 7a, 4 7a 7a, 4 7a 7a, 4	10 A-C 10 D* E*	7a 7a, 4
2 A-C 3 A-C 4 A-C	5a 5a 6a	7, 8 A-C 8 E*		11 A-C E & Fn 4 12 A-C & Fn 4	8a 9a
		9 A-C 9 E*			

* Calculated values

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3. BLOOD MISCELLANEOUS PHYSICAL PROPERTIES

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1-16 AB & Fn 1 17, 18 A-C 19-25 AB	1a 2 4	26-28 AB 29 A C & Fn 2	5 2	30-32 ABC & Fn 3 33-35 AB	5 3b

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4. BLOOD COLLOIDS. OSMOTIC PRESSURE

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1, 2 A-D & Fn 1 3 A-D 4, 5 A-D 6-10 ABCD & Fn 3 11-21 ABCD	4b 3a, 6a 4b 2a, 5a, 7c 4b	22-24 ABCD 25 A-D 26 A-D 27 A-D 28-30 ABCD	2a, 5a 4b 2a, 5a 4b 2a, 5a	31 A-D 32, 33 A-D 34, 35 A-D	4a 2a, 5a 1a, 6a

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7. ERYTHROCYTE FRAGILITY: VERTEBRATES OTHER THAN MAN

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1 A-C	11a	7 A-C	6a	14 A-C	1a
2 A-C	7a	8, 9 A-C	1a	15 A-C	8
3 A-C	3a	10 A-C	2a	16 A-C	9
4 A-C	4a	11 A-C	11a	17, 18, 19 A-C	1a
5 A-C	11a	12 A-C	6a	20 A-C	10
6 A-C	1a	13 A-C	11a	21, 22 A-C	5a

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8. BLOOD COAGULATION. Theory of P. A. Owren (1952)

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Fn 1	1a, 2a
Fn 2	3a, 4a, 5a
Fn 3, 4, 5	6a, 7a
Fn 6	1a, 2a

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Fn 2	2a, 3a
Fn 3	1a
Fn 4	4a
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Fn 2	2a	Fn 5	2a
Fn 3	1a	Fn 6	3a, 4a, 5a

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Fn 2	2a	Fn 6	5a, 6a, 7a
Fn 3	3a	Fn 7	8a
Fn 4	4a	Fn 1-7	9a

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13. BLOOD COAGULATION TIME: MAN

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1 A-E	1a	11 A-E	2a	16 AB DE	9a
2 A-D	1c	12 A DE	4b	17 AB	10
3 A-E	2a	13 AB DE	7a	17 C-E	10a
4,5 A-E	3a	14 AB DE	6a	18 A-E	11
6-9 AB DE	4b	15 ABD	8	Fn 3	8
10 A-E	5a				

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14. HEPARIN-RETARDED COAGULATION TIME: MAN

1,2 A-E	1a	10 A-E	3
3-9 ABC	2	10 EF	3b
3-9 DEF	2b		

Contributors: (a) de Takats, G. (b) Diggs, L.W.

References: (1) de Takats, G., *Angiology* 1:317, 1950. (2) Waugh, T.R., and Ruddick, D.W., *Canad. Med. J.* 50:547, 1944. (3) Tuff, H.S., and Rosenfeld, R.E., *Am. J. Clin. Path.* 17:862, 1947.

15. HEPARIN TOLERANCE MAN

Data Coordinates and Footnotes	Contributors and References
1 AB	1
1 DE	1a
2 A-E	2

Contributor: (a) Diggs, L.W.

References: (1) de Takats, G., *Surg. Gyn. Obst.* 77:31, 1943. (2) Hagedorn, A., and Barker, W., *Am. Heart J.* 35:603, 1948.

16. SKIN BLEEDING TIME. MAN

Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References
1 A-E	1,2b	5 A-E	3a, 7b
2 A-E	3a	6 A-E	6a, 7b
3 A-E	4ab	7 A-E	8
4 A-E	5a		

Contributors (a) Diggs, L. W. (b) Lewis, J. H.

References. (1) Winthrope, M. M., "Clinical Hematology" p 210. Lea & Febiger, Phila. 1946 (2) Duke, W. W., J. Am. Med. Assoc. 55 1185, 1910. (3) Tocantins, L. M., Med. Clin. N. Amer. 130 1361, 1946. (4) Copley, A. L. and Lalich, J. J., J. Clin. Invest. 21:145, 1942 (5) Aggeler, P. M., Howard, J., and Lucia, S. P., Blood 1 472, 1946. (6) Diggs, L. W., unpublished data. (7) Ivy, A. C., Shapiro, P. F., and Melnick P., Surg. Gyn. Obst. 60 781, 1935. (8) Ivy, A. C., Nelson, D., and Bucher, G. R., J. Lab. Clin. Med. 26 1812, 1941.

17. BLOOD CLOT RETRACTION, VOLUME, TIME MAN

Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References
1 A-D	1a	4 CD	4a
2 A CD	4a	5 A-D	3a
3 A-D	2a		

Contributor. (a) Diggs, L. W.

References (1) Aggeler, P. M., Howard, J., and Lucia, S. P., Blood 1 472, 1946 (2) Tocantins, L. M., Med. Clin. N. Amer. 130 1361, 1946. (3) Hirschboeck, J. S., J. Lab. Clin. Med. 22 347, 1948. (4) Diggs, L. W., unpublished data.

18. PLASMA PROTHROMBIN TIME MAN

Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References
1 AB	1	5 A-E	8	10 AB DE	2
1 C EF	1b	5 F	8b	10 C F	2b
2 AB	3	6 AB DE	4	11 AB	7
2 C EF	3b	6 C F	4b	11 C EF	7b
3 AB DE	5	7 AB DE	8	12 AB E	6
3 C F	5b	7 C E	8b	12 C F	6ab
4 A-F	9	8, 9 A-F	9		

Contributors (a) Diggs, L. W. (b) Owen, C. A.

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19. PLASMA PROTHROMBIN. RELATIVE LEVELS VERTEBRATES

Data Coordinates and Footnotes	Contributors and References
1-11 AB Fn 4	Calc. from lab 1

Contributors: (a) Diggs, L.W. (b) Warner, E.D.

References: (1) Warner, E.D., Brinkhous, K.M., and Smith, H.P., Am. J. Physiol. 125 296, 1939.

20. PLASMA ACCELERATOR GLOBULIN. RELATIVE LEVELS: VERTEBRATES

Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References
1,3-6,8B 1-9 C	1c Calc fr. 2abc	Fn 3 Fn 4	1c 4c	Fn 5	2 abc, 3c

Contributors (a) Owen, C.A. (b) Seegers, W.H. (c) Stefanini, M.

References: (1) Quick, A.J., and Stefanini, M., J. Lab Clin Med. 33 819, 1948 (2) Murphy, R.C., and Seegers, W.H., Am. J. Physiol. 154 134, 1948 (3) Ware, A.G., and Seegers, W.H., Am. J. Physiol. 152:567, 1948.

(4) Ware, A.G., and Seegers, W.H., J. Biol. Chem. 172:699, 1948

21. BLOOD PLATELET COUNT MAN

Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References
1 A 2,3 AB 4,5 A 4,5 B 6 AB	1a 1c 2a 2,3 4a	7 AB 8 AB 9 AB 10 AB 11 AB	5cd 6ab 7cd 8c 9c

Contributors (a) Brecher, G. (b) Cronkite, E.P. (c) Diggs, L.W. (d) Lewis, J.H.

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22 BLOOD PLATELET COUNT: LABORATORY, FARM ANIMALS

Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References
1 A-D	7ab	10 A-D	12ab	19 A-D	32b
2 A-D	11ab	& Fn 5		& Fn 6	
3, 5, 9 A-D	1ab	11 A-D	20ab	21 A-D	22ab
4 A-D	21ab	12 A-D	19ab	22 A-D	17ab,c
6 A-D	13ab	13 A-D	19ab	23 A-D	16ab
7 A-D	18ab	14 A-D	8ab	24 A-D	13ab
& Fn 1, 2, 3		15 A-D	10ab	25 A-D	5ab
8, 20 A-D	2ab	16 A-D	4ab	26 A-D	14ab
& Fn 4, 7		17 A-D	9ab	27 A-D	6ab
		18 A-D	8ab		

Contributors (a) Tocantins, L. M. (b) Jaques, L. B. (c) Nice, L. B.

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Note: *quoted from (19)

¹⁰Quoted from Gardner, M. V., *J. Franklin Inst.* 243 77, 172, 1947.

23. CAPILLARY FRAGILITY MAN

Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References
1 A-E	6	11 ABC E	7	11 A-C	6
2-7 ABCDE	2	12 A-D	5a	15 ABC E	1
6-10 ABC E	3b	13 ABC E	5a		

Contributor. (a) Diggs, L. W (b) Proctor, G.

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24. THE ABO SYSTEM OF BLOOD FACTORS AND THEIR FREQUENCIES

Data contributed by Allen, F.H., Wiener, A.S., and Levine, P. Frequencies for General Blood Groups from Snyder, L. H., 20,000 Americans, cited by Boyd, W.C., in *Tabulae Biologicae* 17 Part 2, 1939. Frequencies for Subgroups from Wiener's tests on 1077 whites (N.Y.C.).

25. THE DISTRIBUTION OF THE ABO BLOOD GROUPS IN VARIOUS POPULATIONS

Data contributed by Levine, P., Wiener, A.S., and Levine, V.E. Selections from Weiner, A.S., "Blood Groups and Transfusion," 3rd ed., 1943, C.C. Thomas, Springfield, Ill., from Boyd, W.C. *Tabulae Biologicae* 17, Part 2, 1939, and from Boyd, W.C., "Genetics and the Races of Man," p.223, Little, Brown & Co., Boston, 1950.

26. HEREDITY OF THE ABO BLOOD GROUPS
Application in Disputed Paternity

Modified from Levine, P.

27. HEREDITY OF THE ABO BLOOD SUBGROUPS
Application in Disputed Paternity

Data contributed by Riser, W.H., modified from DeGowin, E.L., Hardin, R.C., Alsever, J.B., "Blood Transfusion," W.B. Saunders Co., 1949

28. THE Rh-Hr (CDE-cde) SYSTEM OF BLOOD FACTORS
AND THEIR FREQUENCIES

Data contributed by Wiener, A.S., Levine, P., Allen, F.H., and Haberman, S. Frequencies for U.S.A. whites (N.Y.C.) from Wiener, A.S. Frequencies for British whites from Race, R.R., et al., 2000 English bloods, in *Blood* 3:689, 1948. Frequencies in footnote 13/ from Hill, J.M., *Am J. Clin. Path.* 17 No 6, 1947.

29. THE DISTRIBUTION OF THE Rh-Hr BLOOD TYPES
IN VARIOUS POPULATIONS

Data contributed by Levine, P., and Wiener, A.S. Selections from Wiener, A.S., *Am J. Clin. Path.* 16:477, 1946.

30. THE MNS SYSTEM OF BLOOD FACTORS AND THEIR FREQUENCIES

Data contributed by Allen, F.H., Wiener, A.S., and Levine, P. Frequencies for 340 English bloods, Pickles, M.M., Nature 162 66, 1946.

31. THE DISTRIBUTION OF THE MN BLOOD FACTORS IN VARIOUS POPULATIONS

Data contributed by Levine, P., and Wiener, A.S. Frequencies from Wiener, A.S., "Blood Groups and Transfusion." 3rd ed., 1941, except for Eskimos contributed by Levine, V.E.

32. HEREDITY OF THE MN BLOOD FACTORS.

Application in Disputed Paternity

Modified from Levine, P.

33. THE K ("KELL-CELLANO") SYSTEM OF BLOOD FACTORS AND THEIR FREQUENCIES

Data contributed by Allen, F.H., and Levine, P. Frequencies from Levine, P. et al., Blood 4 No. 7, 669, July, 1949 for U.S.A. whites, and from Sanger, R., et al., Rev. d'hemat. 4:32, 1949, for English whites.

34. THE Le ("LEWIS") SYSTEM OF BLOOD FACTORS AND THEIR FREQUENCIES

Data contributed by Allen, F.H. Frequencies from Sanger, R., 132 Harvard medical students and Children's Hospital personnel, 1948. Terminology from Race, R.R., et al., Brit. J. Exp. Path. 30:73, 1949.

35. THE Lu ("LUTHERAN") SYSTEM OF BLOOD FACTORS AND THEIR FREQUENCIES

Data contributed by Haberman, S., and Allen, F.H. Nomenclature from Nature 161 580, 1949. Frequencies for 582 English bloods, Callender, S.T., and Race, R.R., Ann. Eugen. 13:102, 1946. Frequencies in footnote 11 for 110 U.S. (Tex.) bloods, Kill, J.M., Haberman, S., and Guy, R., unpublished data.

36. THE P SYSTEM OF BLOOD FACTORS AND THEIR FREQUENCIES

Data contributed by Allen, F.H. Frequencies from Sanger, R., 132 Harvard medical students and Children's Hospital personnel, 1948.

37 BLOOD ERYTHROCYTE VALUES MAN

Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References
1-3 ABC 4-7 ABC & Fn 1, 2 8, 9 A-C Fn 4 10-12 ABC 13 A-C & Fn 5 14 A-C 15 A-C & Fn 6 16 AB	17a, 9j 9j, 11j 17a, d, 6a, 9j 9j 17a, 9j 17a, 10j 7k 17a, 9j 7k	17 A-C & Fn 7 18 AB 19-21 ABC Fn 8 22 A-C & Fn 9 23 A-C & Fn 10 24-26 ABC 27 A-C & Fn 11 28-33 ABC & Fn 12 34 A-C	g, 9j 7k 9j 7k j, 8c 8cn 9j 3b, 9j, 18 6h 9j	35 AB 36, 37 A-C 38, 39 A-C 40, 41 A-C 42, 43 A-C 44, 45 A-C 46 A-C 47, 48 AB & Fn 14 49 A-C 50-52 AB & Fn 15 53-65 AB	17a, 9j 12i 13i 14i 15m 16m 1c 2f 4e, 19b 17a, 9j, 19b

Contributors: (a) Bethell, F. H. (b) Collier, H. B. (c) Dole, V. P. (d) Drabkin, D. L. (e) Ferguson, J. H. (f) Gram, H. C. (g) Guest, G. M. (h) Heath, C. W. (i) Hirschboeck, J. S. (j) Osgood, E. E. (k) Ponder, E. (m) Riser, W. H., Jr. (n) Van Slyke, D. D. (o) Wintrobe, M. M.

References: (1) Abramson, H. A., J. Gen. Physiol. 12:711, 1929. (2) Gram, H. C., Am. J. Med. Sci. 168 521, 1924. (3) Drabkin, D., Am. J. Clin. Invest. 26 636, 1947. (4) London, I., et al., J. Biol. Chem. 179 463, 1949. (5) Parpart, A. K., et al., "Hemolysis and Related Phenomena" Grise & Stratton, New York, 1948. (6) Van Slyke, D. D., et al., J. Biol. Chem. 183 305, 1950. (7) Osgood, E. E., Arch. Int. Med. 58 849, 1935. (8) Van Slyke, D. D., et al., Am. J. Physiol. 128:382, 1940. (9) Ponder, E., P. 597 in "Medical Physics." Otto Glasser, Editor, Chicago Year Book Publishers, 1944. (10) Westergren, A., Am. Rev. Tuberc. 14:94, 1926. (11) Wintrobe, M. M., and Landsberg, J. W., Am. J. Med. Sci. 189 102, 1935. (12) Cutler, J. W., Am. J. Med. Sci. 183 251, 1936. (13) Daland, G. A., and Worthley, K., J. Lab. Clin. Med. 20 1122, 1935. (14) Giffin, H. Z., and Sanford, A. H., J. Lab. Clin. Med. 4 465, 1919. (15) Bethell, F. H., "Clinical Laboratory Diagnosis and Essentials of Hematology." The Edwards Letter Shop, Ann Arbor, Michigan, 1948. (16) Grinstein, M., and Moore, C. V., J. Clin. Invest. 28 505, 1949. (17) Callender, S. T., Powell, E. O., and Witts, L. J., J. Path. Bact. 57 129, 1945. (18) Gregersen, M. I., and Schiro, H., Am. J. Physiol. 121:284, 1938.

38 BLOOD ERYTHROCYTE, HEMATOCRIT, HEMOGLOBIN AND THROMBOCYTE VALUES, BIRTH TO MATURITY MAN

Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References
*1-18 BC 20-22 BC 1, 3-12 DE 22 DE *1-18 F 20-22 F *1-18 G	7bi, 8bi, d, 14e, 15e, 1f, 2j 9g 4h 10g d, 14e, 15e, 2j 9g d, 2j	20 G 21 G 22 Q 1-18 HI 1-18 J	Calc fr 9g, (20F)x 10/(20B) Calc fr 9g, (21F)x 10/(21B) Calc fr 9g, (22F)x 10/(22B) d, 14e, 15e, 1f, 3f, 5f, 2j Calc fr (1-18H) x 10/(1-18B)	1-18 K 20-22 HI 20-22 J 20-22 K *1, 3-12 LM 22 LM Fn 4 Fn 7	Calc fr (1-18H) x 100/(1-18F) 9g 9g 9g, 16a 1f 6, 11c, 12 13 7bi, 8bi

*Note These values are smoothed means and sample ranges from plotted curves based on averages of the data referred to.

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References: (1) Merritt, K. K., and Davidson, L. T., Am. J. Dis. Child 46 991, 1900, 1001, 1008, 1933. (2) Wintrobe, M. M., "Clinical Hematology" 2nd ed., p. 73, Lea & Febiger, Philadelphia, 1948. (3) Williamson quoted by Merritt, K. K., and Davidson, L. T., Am. J. Dis. Child 46 991, 1933. (4) Washburn, A. H., Am. J. Dis. Child. 62 530, 1941. (5) Elvehjem, C. A., et al., Am. J. Dis. Child. 46 105, 1933. (6) Rees, H. M., and Ecker, E. E., J. Am. Med. Assoc 116:2568, 1941. (7) DeMarsh, Q. B., Alt, H. L., Windle, W. F., Am. J. Dis. Child 75 860, 1948. (8) Osgood, E. E., Arch. Int. Med. 80:621, 1923. (9) DeMarsh, Q. B., Alt, H. L., Windle, W. F., Am. J. Dis. Child 75 860, 1948. (10) DeMarsh, Q. B., Alt, H. L., Windle, W. F., Am. J. Dis. Child 75 860, 1948.

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Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References
1 C-E	1a	7 C-E	7a	13 C-E	13a
2 C-E	2a	8 C-E	8a	14 C-E	14a
3 C-E	3a	9 C-E	9a	15 C-E	15a
4 C-E	4a	10 C-E	10a	16 C-E	16a
5 C-E	5a	11 C-E	11a	17 C-E	17a
6 C-E	6a	12 C-E	12a	18 C-E	18a

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Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References
1 C-F	1a	7 C-F	7a	13 C-F	10a
2 C-F	2a	8 C-F	8a	14 C-F	9a
3 C-F	3a	9 C-F	9a	15 C-F	12a
4 C-F	4a	10 C-F	9a	16 C-F	9a
5 C-F	5a	11 C-F	10a	17 C-F	9a
6 C-F	6a	12 C-F	11a	18 C-F	13a

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 Dill, D. of 2 431 1950 (12) Talbot, J.H., and
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42. BLOOD ERYTHROCYTTIC VALUES: MAMMALS, LABORATORY

Data Coordinates	Contributors and References	Data Coordinates	Contributors and References	Data Coordinates	Contributors and References
Cat 1B	Av. of means from 4,8,15, 34,36,44,46,49,50,82,94,95, 115,128,129,147,162,198, 199,200,201,230,235	2J	Av. of means from 7,6,21a, 22a, 27, 68, 84a, 85, 137, 139, 160, 193, 242	Rabbit 5B	Av. of means from 1,5,14, 15,16,17,19,20,28,29,30,31, 34,39,40,43,51,52,58,59,60, 61,62,63,67,68,76,77,78,82, 86,90,91,97,100,101,102, 103,104,109,112,113,114, 120,121,132,133,134,140, 143,144,151,153,156,165, 166,167,168,169,170,171, 173,175,177,178,180,181, 188,182,191,194,195,198, 204,207,216,217,218,219, 220,221,222,227,228,233, 232,235,241,242,252
1C	Av. of ranges from 34,36, 49,82,95,115,168,189,201	2K	Av. of ranges from 7, 242	5C	Av. of ranges from 1,5,16, 17,18,20,28,29,30,31,43,51, 52,59,60,61,62,67,76,78,82, 86,90,91,97,101,102,103,109, 113,114,120,121,132,133, 140,143,168,169,170,171, 175,179,180,188,195,204, 207,216,217,218,221,233,252
1D	116,119	2L	Av. of means from 27,192d	5D	Av. of means from 82,186, 221
1F	Av. of means from 9,13,15, 82,93,94,115,147,148,183, 202,203,236	2M	Calc. from (2L)x100/(2J)	5E	221
1G	Av. of ranges from 9,15,94, 203,236	2N	Av. of ranges from 7,27, 137,160,242	5F	169
1H	129	2O	Calc. from (2L)x10/(2B)	5G	c
1I	c	2P	Av. of ranges from 7,27, 137,160,161,242	5H	c
1J	129	Guinea Pig 3B	Av. of means from 12,15, 23,33,34,38,42,44,56,73,82, 86,87,88,94,98,115,122,140, 153,156,163,173,177,178, 210,211,212,232,244	5I	Av. of means from 43,104, 186,220,242
1K	Calc. from 129	3C	Av. of ranges from 12,23, 33,34,38,82,86,87,88,115, 122,149,156,178,210,232	5J	Av. of means from 40,58, 81,104,220,242
1L	Av. of means from 129,50, 201,225,230,248	3D	Av. of means from 3,10,12, 87,88,211	5K	Calc. from 242
1M	Calc. from 129	3E	Av. of ranges from 12,87,88	5L	Av. of means from 40,58, 81,104,220,242
1N	Calc. from (1L)x100/(1J)	3F	Av. of means from 15,33, 44,71,82,93,94	5M	Calc. from (5L)x100/(5J)
1O	c	3G	Av. of means from 56,67, 117,193,244	5N	Range interval fr. c
1P	Calc. from (1L)x10/(1B)	3H	Av. of means from 56,67, 117,193,244	5O	Calc. from (5L)x10/(5B)
1Q	Range interval fr. c	3I	c	5P	c
Dog 2B	Av. of means from 2,6,7, 18,20,24,25,26,27,28,29,32, 34,35,37,44,47,49,51,52,53, 54,55,57,70,82,83,94,96,97, 110,115,123,124,125,126, 128,130,131,132,133,134, 135,136,137,149 through 161,174,175,176,178,182, 184,185,186,190,191,192, 200,204,205,206,207,208, 227,231,232,235,237,238, 239,240,241,242,246,249, 251	3J	Av. of means from 56,67, 117,193,244	5Q	c
2C	Av. of ranges from 2,6,18, 20,25,28,29,32,34,35,37,44, 49,51,52,53,54,55,70,82,83, 86,97,110,123,124,125,126, 128,131,132,133,135,136, 149,152,154,157,158,159, 174,175,179,182,184,185, 186,190,192,204,206,207, 208,231,232,238,239,240, 246	3K	Av. of means from 56,67, 212,244	6B	Av. of means from 41,45, 48,58,105,106,127,148,197, 229,245,250,254
2D	Av. of means from 116,119, 192d	3L	Calc. from (3L)x100/(3J)	6C	Av. of ranges from 105, 146,250
2E	192d	3M	Range interval fr. c	6D	Av. of means from 27,45, 48,223,224,229,255,258
2F	Av. of means from 13,44, 53,71,72,82,93,94,106,115, 137,138,146,162,183,202, 203,204,209,226,233,243	3N	Calc. from (3L)x10/(3B)	6E	234
2G	Av. of ranges from 44, 53, 72, 84, 115, 138, 202, 203, 209	3O	Calc. from (3L)x10/(3B)	6F	189
2H	Av. of means from 7,27 137, 160, 242	3P	Range interval fr. c	6G	c
2I	Range interval fr. 7,27,137 160, 242	3Q	Range interval fr. c	6H	242
		Mouse 4B	Av. of means from 45,56, 58,74,81,82,111,115,118, 141,142,153,167,213,244	6I	c
		4C	Av. of ranges from 74,75, 115, 116,119	6J	Av. of means from 11,48, 63,69,80,107,117,127,172, 242,253
		4D	Av. of means from 62,202	6K	242
		4E	Av. of means from 56,187, 244	6L	Av. of means from 11,45, 48,58,99,106,172,197,229, 245
		4I	Av. of means from 56,187, 193	6M	Calc. from 172
		4J	Av. of means from 56,58, 79,80,89,99,214,111,215	6N	Calc. from (6L)x100/(6J)
		4L	Calc. from 99	6O	c
		4M	Calc. from (4L)x100/(4J)	6P	Calc. from (6L)x10/(6B)
		4N	Range interval fr. c	6Q	Range interval fr. c
		4O	Calc. from (4L)x10/(4B)		
		4P	Range interval fr. c		
		4Q			

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43. HEMATOCRIT VALUES AND HEMOGLOBIN CONCENTRATIONS OF BLOOD. VERTEBRATES

Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References
1 B D	14d	7 F	Calc. from (7D x 100/7B)	13 B	1, 3, 12
1 F	14d, 40b		Av. of 1, 12-18	13 D	1, 34
2 B D	1	8 B	Calc. from 13	13 F	Calc. from (13D x 100/13B)
2 F	Calc. from (2D x 100/2B)	8 D	Av. of 14-24	14 B	3, 12
3 B	2, 3, 4	8 E	17	14 D	23
3 C	Calc. from 4	8 F	Calc. from (8D x 100/8B)	14 F	Calc. from (14D x 100/14B)
3 D	Av. of 2, 5, 4, 7		Av. of c, 3, 12, 25, 26	15 B	3, 12
3 E	Calc. from 2	9 B	Calc. from c	15 D	1
3 F	Calc. from (3D x 100/3B)	9 C	Av. of c, 25-27	15 F	Calc. from (15D x 100/15B)
4 B	8	9 D	Calc. from c	16 B-F	36a
4 C	Calc. from c	9 E	Calc. from (9D x 100/9B)	17 B D	1, 37
4 D	Av. of c, 1, 8	9 F	Av. of 1, 11, 28	17 F	Calc. from (17D x 100/17B)
4 E	Calc. from c	10 B	Calc. from 11		36a
4 F	Calc. from (4D x 100/4B)	10 C-E	Calc. from (10D x 100/10B)	18 B-F	1, 12
5 B-E	9	10 F	1, 12, 29, 30	19 B	1
5 F	Calc. from (5D x 100/5B)	11 B	1, 31, 32	19 F	Calc. from (19D x 100/19B)
6 B	Av. of 3, 8, 10, 11, 12	11 D & F n 6	Calc. from (11D x 100/11B)	20 E	38a
6 C	Calc. from 11		3, 12	21 B D	1
6 D	Av. of 10, 11	12 B	Av. of 31, 33	21 F	Calc. from (21D x 100/21B)
6 E	Calc. from 11	12 D	Calc. from 33		8
6 F	Calc. from (6D x 100/6B)	12 E	Calc. from (12D x 100/12B)	22 B-F	
7 B D	11	12 F			

(Continued on the next page)

Contributors: (a) Atlans, F.D. (b) Bethell, F.H. (c) Cronkite, E.P. (d) Osgood, E.E.

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44. BLOOD ERYTHROCYTE VALUES: FISH

Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References
Fn 1	d	9 A-F	7d	15 F	d
1 AB D	4d	10 A-F	3b	16 AB DE	2ad
1 C	5a	11 A-F	3ab	16 C	6d
2, 3 A-D F	1ac	12 AB DE	2ad	16 F	d
4-6 ABCDEF	3b	12 F	6	17-22 ABCDEF	3b
7 A-F	7d	13, 14 A-C	5a	23 AB DE	2d
8 A-F	3b	15 AB DE	2ad	24, 25 A-D F	1ac

Contributors: (a) Hart, J.S. (b) Kisch, B. (c) McCutcheon, F.H. (d) Root, R.W.

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45. ERYTHROCYTE DIAMETERS: MAMMALS

Data Coordinates and Footnotes	Contributors and References
1 AB	2b
2-11C AB & Fn 2,2	1c, x

Contributors: (a) Handley, C. O., Jr.: contributed common and accepted scientific names. (b) Osgood, E. E. (c) Ponder, E.

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46. BLOOD ERYTHROCYTE VALUES IN FETUS, NEWBORN, AND IN ADULT FEMALE: MAMMALS

Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References
1-5BC, 14-17BC, 26-29BC, 38-41BC, 50-51BC	11ad	2-9FG, 12FG, 14- 21FG, 24FG, 28- 32FG, 38FG, 38- 43FG, 48FG, 50- 57FG, 80FG	8ad	7-9NO, 19N, 20NO, 10-12NO, 22, 23NO, 24N	5ad 13ad
10BC, 24BC, 48BC, 52BC	3ad	14H, 16H, 17-19H, 20H, 21H, 22H, 24H, 26H, 29-31H, 32H, 32H, 34H,	3ad	34, 35NO, 36N, 43N, 44NO, 46, 47NO, 48N, 55N, 58NO, 58, 59NO, 60N, Fn 11, 12	6ad 13ad
12BC, 24BC, 48BC, 60BC	7bc	36H, Fn 8, 10		3PQ, 5P, 7P, 8PQ, 15PQ, 17P, 19P, 20PQ, 30P, 41P, 43P, 44PQ, 51PQ, 53P, 55P, 56PQ	
22BC	10ad	1-8JK, 10, 11JK, 12J, 13-20JK, 22, 23JK, 24J, 28-33JK	12ad, 13ad	52P, 54P, 48P, 60P 25-33PQ	8ad 1ad
26BC	4	35JK, 38-44JK, 48, 47JK, 48J, 49-56JK, 58, 59JK, 60J, Fn 7, 8			
Fn 3	14ad				
Fn 2, 4	ad				
5-YDE, 10DE, 12D, 17-19DE, 22DE, 24D, 28-31DE, 34DE, 38D, 41-42DE, 46DE, 48D, 51-53DE, 58DE, 60D, Fn 4	12ad, 13ad				

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47. ERYTHROCYTE OXYGEN CONSUMPTION

Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References
1 A CDE	8ab	9 A CDE	5ab	17 AB DE	4ab
2 A-E	2ab	9-12 ABCDE	7a	18 A CDE	8ab
3 A CDE	1ab	13 A-E	1ab	19 AB DE	6ab
4 A CDE	5ab	14 A-E	8ab	20 A CDE	5ab
5, 6 A-E	7ab	15 AB DE	6ab	21, 22 A-E	7a
7 AB DE	4ab	16 A-E	7ab	23 A-E	5ab
				24, 25, 26 A-E	7a

Contributors (a) Hunter, F.R. (b) Ponder, E.

References: (1) Dymally, W. A. and Warren, E. S. G., J. Exp. Med., 46: 257, 1928. (3) K. and Warren, C. 1933, 1938. (5) Ramsey, 158: 121, 1925. (6) Segler-Soru, E., Arch. internal physiol. 31: 413, 1933. (7) Berg, O., Z. physiol. Chem., 1933, 1938.

44. ERYTHROCYTE CARBOHYDRATE METABOLISM

Data contributed by Spicer, S.S., from Spicer, S.S., and Clark, A.M. J. Biol. Chem. 179:987, 1949, and Spicer, S.S., J. Pharm. Exp. Therap. 99:185, 1950.

49. BLOOD LEUKOCYTE VALUES, BIRTH TO MATURITY: MAN

Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References
Fn 3 Fn 6 1-46 B	7,8,9 Sum of (1-46 D J L N P) checked against I	42-46 F	(#1-45 B and #1-45 F) 39 and (#1-45 D) #1-45 B and #1-45 H)	#1-45 N #2-46 H	44 (#1-45 B and #1-45 N)
#1-45 C Fn 8 #1-45 D #2-46 D	28 34 37 (#1-45 B and #1-45 D)	#1-45 J #2-46 J	40 (#1-45 B and #1-45 J)	#1-45 O #2-46 O	46 (#1-45 B and #1-45 O) 25 through 27
#1-45 E 2,4,6 E 8 E #1-45 F	38 7,8 6 39 and (#1-45 D)	#1-45 K #1-45 L #2-46 L	42 41 (#1-45 B and #1-45 L)	27-38 G 44, 46 G #1-45 I	5 (#2-45 E and #1-45 I) 25 through 27 25 through 27,5
		#1-45 M	43	#2-42 I 44, 46 I	

Note # Even numbers only
Odd numbers only

Contributors: (a) Brown, G. O. (b) Diggs, L. W. (c) Glaser, K. and Ljmarzi, L. R. (d) Hamre, C. J. (e) Harrell, G. T.
(f) Osgood, E. E. (g) Smith, C. A. (h) Wintrobe, M. M. (i) Zwemer, R. L.

Note: * quoted by reference III
** quoted by reference 24
*** quoted by reference 29
@ quoted by reference 7
@@ quoted by reference 30
@@@ quoted by reference 35

References: (1) Smoothed curve of total leukocyte counts at different ages, based on averages of mean total leukocyte counts from references 2 through 27. (2) Glaser, K., Ljmarzi, L. R., and Poncher, H. G., *Pediatrics* 6: 789, 1950, (contributed by c). (3) Poncher, H. G., 1945. (4) Chulnard, E. G., 1941. (5) Brown, G. O., unpublished data (contributed by a). (6) Kato, K., *J. Pediatr.* 7: 1935. (7) Lippman, H. S., *Am. J. Dis. Child.* 27: 473, 1924. (8) Forkner, C. E., *Bull. Johns Hopkins Hosp.* 25: 75, 1929 (contributed by d). (9) Wegelius, R., *Acta Med. Scand. Suppl.* 4, 1948 (contributed by g). (10) Elder and Hutchinson. (11) Wolno-Oranski, quoted by Fehrsen. (12) Attkin, J., *J. Obst. Gynec.* 1: 414, 1902. (13) Barbosa, J. M., *Oporto.* (14) Washburn, A. H., *Am. J. Dis. Child.* 20: 413, 1935. (15) Lucas, W. P., *Am. J. Dis. Child.* 22: 525, 1921. (16) Perlin, *Jahrb. Kinderh.* 58: 549, 1903. (17) Karntnik, A., *Arch. Kinderh.* 35: 42, 1904. (18) Bethell, F. H., 1943. (19) Magnusson, J. H., *Acta paediat.* 23: 14, 1938. (20) Suzuki, 1937. (21) Goldhamer, S. M., *J. Lab. Clin. Med.* 17: 1043, 1932. (22) Benjamin B., and Ward, S. M., *Am. J. Dis. Child.* 60: 22, 1940 (contributed by d). (23) Wollstein, M., *The Normal Blood in Infants and Children*, in H. Downey's "Handbook of Hematology," Paul Hoeber, Inc., New York, vol. 2, 1938. (24) Hamre, C. J., and Wong, K. K. L., *Am. J. Dis. Child.* 60: 22, 1940 (contributed by d). (25) Osgood, E. E., et al., *Am. J. Dis. Child.* 58: 51, 282, 1938 (contributed by b). (26) Osgood, E. E., et al., *J. Lab. Clin. Med.* 24: 905, 1939 (contributed by f). (27) Osgood, E. E., et al., *Arch. Int. Med.* 64: 105, 1939 (contributed by f). (28) Sturgis, C. C., and Bethell, F. H., *Physiol. Rev.* 23: 279, 1943 (contributed by i). (29) Smith, C. A., *"Normal Values in Clinical Medicine,"* W. B. Saunders Co., Philadelphia, 1949 (contributed by g). (30) Smith, C. A., *"The Physiology of the Newborn Infant,"* C. C. Thomas, Springfield, 1950 (contributed by g). (31) Smoothed curves of upper and lower limits of range of total leukocyte counts at different ages, based on averages - (means of range limits from references 5,7,8,9,12,14,15,25,26,27,33,34,35,38. (32) Fehrsen, A. O. M., *J. Physiol.* 30: 322, 1903. (33) Kolmer, J. A., and Boerner, F., *"Approved Laboratory Technique,"* 4th ed., D. Appleton-Century Company, Inc., New York, 1945. (34) Garrey, W. E., (contributed by h). (35) Butall, L. W., and Harrell, G. T., *North Carolina Med. J.* 7: 441, 1946. (36) Feigler, Phila., 1946 (contributed by b). (37) Smoothed curve of total neutrophil counts at different ages, based on averages of mean neutrophil counts from references 2 through 9,13,14,15,11, 18 through 27. (38) Smoothed curves of means of range limits of upper and lower limits of range of total neutrophil counts at different ages, based on averages of total neutrophil counts at different ages based on averages of mean neutrophil counts from references 2,3,4,5,7,8,9,14,15,13, 18 through 27. (39) Smoothed curves of percentages of band forms in total neutrophils from references 2,3,4,5,7,8,9,14,15,13, 18 through 27. (40) Smoothed curve of eosinophil counts at different ages, based on averages of mean eosinophil counts from references 2,3,4,5,7,8,9,14,15,13, 18 through 27. (41) Smoothed curves of basophil counts at different ages, based on averages of mean basophil counts at different ages, based on averages of percentages of band forms in differential counts, from references 2,3,4,5,7,8,9,14,15,13, 18 through 27. (42) Smoothed curves of lymphocyte counts at different ages, based on averages of mean lymphocyte counts from references 2,3,4,5,7,8,9,14,15,13, 18 through 27. (43) Smoothed curves of monocyte counts at different ages, based on averages of mean monocyte counts at different ages, based on averages of percentages of band forms in differential counts, from references 2,3,4,5,7,8,9,14,15,13, 18 through 27. (44) Smoothed curves of lymphocyte counts at different ages, based on averages of mean lymphocyte counts at different ages, based on averages of percentages of band forms in differential counts, from references 2,3,4,5,7,8,9,14,15,13, 18 through 27. (45) Smoothed curves of monocyte counts at different ages, based on averages of mean monocyte counts at different ages, based on averages of percentages of band forms in differential counts, from references 2,3,4,5,7,8,9,14,15,13, 18 through 27. (46) Smoothed curves of lymphocyte counts at different ages, based on averages of mean lymphocyte counts at different ages, based on averages of percentages of band forms in differential counts, from references 2,3,4,5,7,8,9,14,15,13, 18 through 27. (47) Smoothed curves of monocyte counts at different ages, based on averages of mean monocyte counts at different ages, based on averages of percentages of band forms in differential counts, from references 2,3,4,5,7,8,9,14,15,13, 18 through 27.

50. BLOOD LEUKOCYTE VALUES AT ALTITUDE MAN

Data contributed by Diggs, L. W., from Hurtado, A., Merino, C., and Delgado, E., Arch. Int. Med. 75 284, 1945

51. BLOOD LEUKOCYTE VALUES IN FREQUENCY AND POSTPARTUM MAN

Data contributed by Bethell, F. H., from Sturgis, C. C., and Bethell, F. H., Physiol. Rev. 23 179, 1943,

52 BLOOD LEUKOCYTE COUNTS, ABSOLUTE AND DIFFERENTIAL: MAMMALS, LABORATORY

Data Coordinates	Contributors and References	Data Coordinates	Contributors and References	Data Coordinates	Contributors and References
1A	Smoothed av. of means fr 1 through 14	7A	Smoothed av. of means fr. 5,6,7,8,10,11,15, 26 through 91,92b	12D	49,50,53,54,55,60,61,62,63, 71,72,73,74,89,90,92b,94
2B	Calc. & smoothed fr. (2D x 1B)	8B	Calc. & smoothed fr. (8D x 7B)	8E	Smoothed av. of means fr. 3,4,8,33,34,35,36,39,44,50, 53,54,55,60,62,63,71,72, 73,76,89,90,92b,94
3B	Calc. & smoothed fr. (3D x 1B)	9B	Calc. & smoothed fr. (9D x 7B)	9E	Smoothed av. of ranges fr. 3,4,5,30,33,35,39,44,46,60, 61,66,72,76,78,82b
4B	Calc. & smoothed fr. (4D x 1B)	10B	Calc. & smoothed fr. (10D x 7B)	10E	Smoothed av. of ranges fr. 3,4,5,30,33,35,39,44,60, 61,66,72,76,78,82b
5B	Calc. & smoothed fr. (5D x 1B)	11B	Calc. & smoothed fr. (11D x 7B)	11E	Smoothed av. of ranges fr. 3,4,33,35,39,44,60,61,72, 76,78,82b
6B	Calc. & smoothed fr. (6D x 1B)	12B	Calc. & smoothed fr. (12D x 7B)	12E	Smoothed av. of ranges fr. 3,4,33,35,39,44,60,61,72, 76,78,82b
1C	Smoothed av. of ranges fr. 1,2,3,4,5,8,10,12,15,16,17, 18,19,20,21	7C	Smoothed av. of ranges fr. 4,5,8,10,11,26,27,30,32,33, 34,35,36,39,40,41,42,43,44, 46,47,48,49,50,51,52,53,54, 56,58,59,60,61,64,65,66,72, 73,74,75,76,78,82,84,82b, 93	Rabbit 13B	Smoothed av. of means fr. 3,4,5,7,8,10,11,23,30,33, 37,47,49,51,53,56,67,68,69, 72,73,74,82,84,95 through 150,152 through 159,224, 225,226
2C	Calc. & smoothed fr. (2E), (1C), (1B)	8C	Calc. & smoothed fr. (8E), (7C), (7B)	14B	Calc. & smoothed fr (14D x 13B)
3C	Calc. & smoothed fr. (3E), (1C), (1B)	9C	Calc. & smoothed fr. (9E), (7C), (7B)	15B	Calc. & smoothed fr (15D x 13B)
4C	Calc. & smoothed fr. (4E), (1C), (1B)	10C	Calc. & smoothed fr. (10E), (7C), (7B)	16B	Calc. & smoothed fr (16D x 13B)
5C	Calc. & smoothed fr. (5E), (1C), (1B)	11C	Calc. & smoothed fr. (11E), (7C), (7B)	17B	Calc. & smoothed fr. (17D x 13B)
6C	Calc. & smoothed fr. (6E), (1C), (1B)	12C	Calc. & smoothed fr. (12E), (7C), (7B)	18B	Calc. & smoothed fr (18D x 13B)
2D	Smoothed av. of means fr. 1,2,4,5,6,8,11,12,17,19,22, 23,24	8D	Smoothed av. of means fr. 3,4,5,6,8,11,13,29,30,33, 34,35,36,38,39,43,44,49,50, 51,53,54,55,60,61,62,63,71, 72,73,75,76,78,83,89,90, 92b,93,94	13C	Smoothed av. of ranges fr. 3,4,5,8,11,30,33,37,47,51, 53,67,69,74,77,78,93,96, 102,103,104,105,106,108, 109,110,111,113,114,115, 116,118,119,120,121,122, 123,126,127,129,130,131, 132,135,136,137,138,140, 141,142,143,144,145,146, 147,149,151,156,157,224, 225,226
3D	Smoothed av. of means fr. 1,2,4,5,6,8,11,12,17,19,22, 23,24	9D	Smoothed av. of means fr. 3,4,5,6,8,11,13,29,30,33,34, 35,36,38,44,48,49,53,54,55, 60,61,62,63,71,72,73,76,89, 90,92b,94		
4D	Smoothed av. of means fr. 1,2,4,5,6,8,11,17,19,21,22, 23,24	10D	Smoothed av. of means fr. 4,8,34,35,39,44,50,53,66, 92b		
5D	Smoothed av. of means fr. 1,2,4,5,6,8,11,17,19,21,22, 23,24	11D	Smoothed av. of means fr. 3,4,8,29,33,34,35,36,39,44,		
6D	Smoothed av. of means fr. 1,2,4,5,6,8,11,17,19,21,22, 23,24				
2E	Smoothed av. of ranges fr. 5,8,16,18				
3E	Smoothed av. of ranges fr. 5,8,16,18				
4E	Smoothed av. of ranges fr. 5,8,16,18				
5E	Smoothed av. of ranges fr. 5,8,16,18				
6E	Smoothed av. of ranges fr. 5,8,16,18				

(Continued on the next page)

Data Coordinates	Contributors and References	Data Coordinates	Contributors and References	Data Coordinates	Contributors and References
14C	Calc. & smoothed fr. (14E) (13C), (13B)	4F	Calc. & smoothed fr. (4H x 1F)		190,191,192,193,194,195, 196,197,198,199,200,201, 202,203,204,205,206,207, 208,209,210,211,212
15C	Calc. & smoothed fr. (15E) (13C), (13B)	5F	Calc. & smoothed fr. (5H x 1F)		Calc. & smoothed fr. (14H x 13F)
16C	Calc. & smoothed fr. (16E) (13C), (13B)	6F	Calc. & smoothed fr. (6H x 1F)	14F	Calc. & smoothed fr. (15H x 13F)
17C	Calc. & smoothed fr. (17E) (13C), (13B)	1G	95% range calc. fr. 175a	15F	Calc. & smoothed fr. (16H x 13F)
18C	Calc. & smoothed fr. (18E) (13C), (13B)	2-6G	Smoothed av. based on ranges fr. 53,175a,181, 183,184,185	16F	Calc. & smoothed fr. (17H x 13F)
14D	Smoothed av. of means fr. 4,5,8,11,23,33,44,51,53,55, 56,93,94,96,97,100,104, 105,106,107,108,118,123, 125,130,131,134,135,136, 141,142,148,151,155,156, 160,224,227	2H	Smoothed weighted av. of means fr. 159,170,174,175a, 177,178,179,180,182	17F	Calc. & smoothed fr. (18H x 13F)
15D	Smoothed av. of means fr. 4,5,8,11,33,56,94,100,104, 112,113,116,119,123,130, 131,134,135,141,148,151, 155,156,160,224,225,227	3H	Smoothed weighted av. of means fr. 174,175,180,182	18F	Calc. & smoothed fr. (19H x 13F)
16D	Smoothed av. of means fr. 4,5,8,33,94,96,100,105,108, 112,113,116,119,123,148, 151,155,156,225,227	4H	Smoothed weighted av. of means fr. 170,174,180,182	13G	Smoothed av. of ranges fr. 3,4,8,74,123,187,188,189, 190,184,200,201,202,203, 204,207,208,209,210
17D	Smoothed av. of means fr. 3,4,5,8,23,24,33,53,55,56, 78,94,96,100,104,107,108, 112,113,118,125,130,131, 134,135,141,142,148,151, 155,156,158,159,160,224, 225,227	5H	Smoothed weighted av. of means fr. 159,170,174,175, 178,180,182	14G	Calc. & smoothed fr. (14I), (13G), (13F)
18D	Smoothed av. of means fr. 3,8,33,53,55,94,96,100,107, 112,113,118,130,131,134, 135,141,148,151,155,156, 160,224,225,227	6H	Smoothed weighted av. of means fr. 174,181,182	15G	Calc. & smoothed fr. (15I), (13G), (13F)
14E	Smoothed av. of ranges fr. 8,11,24,51,67,78,130,135, 137,145,146,161,162,163, 224	1-3I	95% range calc. fr. 183	16G	Calc. & smoothed fr. (16I), (13G), (13F)
15E	Smoothed av. of ranges fr. 3,4,5,8,11,33,78,102,108, 113,115,119,130,135,137, 162,163,224	4I	184	17G	Calc. & smoothed fr. (17I), (13G), (13F)
16E	Smoothed av. of ranges fr. 3,4,5,8,11,24,33,102,106, 108,113,115,119,130,135, 145,146,162,163	5-6I	95% range calc. fr. 183	18G	Calc. & smoothed fr. (18I), (13G), (13F)
17E	Smoothed av. of ranges fr. 3,4,5,8,24,33,78,102,106, 108,113,115,119,130,137, 145,162,224	Mouse		14H	Smoothed av. of means fr. 3,5,8,23,24,55,123,163,190, 191,192,194,198,199,202, 204,205,206,208,210,211, 212,213,214
18E	Smoothed av. of ranges fr. 8,24,78,101,102,106,107, 113,115,119,130,135,137, 145,146,162,224	7F	Smoothed av. of means fr. 4,5,8,55,69,164,165,166	15G	Smoothed av. of means fr. 5,8,23,55,58,188,190,191, 192,197,198,199,201,202, 204,205,210,212,214,215, 218
19E	Smoothed av. of ranges fr. 8,24,78,101,102,106,107, 113,115,119,130,135,137, 145,146,162,224	8F	Calc. & smoothed fr. (8H x 7F)	16H	Smoothed av. of means fr. 3,5,8,23,55,58,123,163,186, 187,190,191,192,198,199, 202,204,205,210,212
20E	Smoothed av. of ranges fr. 8,24,78,101,102,106,107, 113,115,119,130,135,137, 145,146,162,224	9F	Calc. & smoothed fr. (9H x 7F)	17H	Smoothed av. of means fr. 3,5,8,23,24,55,56,123,183, 188,190,191,192,194,198, 199,202,204,205,208,210, 211,212,214,229
21E	Smoothed av. of ranges fr. 8,24,78,101,102,106,107, 113,115,119,130,135,137, 145,146,162,224	10F	Calc. & smoothed fr. (10H x 7F)	18H	Smoothed av. of means fr. 3,8,55,56,186,190,192,198, 199,202,204,205,208,210, 212
22E	Smoothed av. of ranges fr. 8,24,78,101,102,106,107, 113,115,119,130,135,137, 145,146,162,224	11F	Calc. & smoothed fr. (11H x 7F)	14I	Smoothed av. of ranges fr. 3,4,5,8,56,78,187,188,190, 193,197,198,212,217,218, 219,230
23E	Smoothed av. of ranges fr. 8,24,78,101,102,106,107, 113,115,119,130,135,137, 145,146,162,224	12F	Calc. & smoothed fr. (12H x 7F)	15I	Smoothed av. of ranges fr. 3,4,5,8,123,183,187,190, 193,198,201,202,212,215, 217,230
24E	Smoothed av. of ranges fr. 8,24,78,101,102,106,107, 113,115,119,130,135,137, 145,146,162,224	7G	Smoothed av. of ranges fr. 4,8,164	16I	Smoothed av. of ranges fr. 4,8,190,193,198,202,212, 217,230
25E	Smoothed av. of ranges fr. 8,24,78,101,102,106,107, 113,115,119,130,135,137, 145,146,162,224	8G	Calc. & smoothed fr. (8I), (7G), (7F)	17I	Smoothed av. of ranges fr. 3,4,5,8,78,187,188,190,193, 197,198,212,217,230
26E	Smoothed av. of ranges fr. 8,24,78,101,102,106,107, 113,115,119,130,135,137, 145,146,162,224	9G	Calc. & smoothed fr. (9I), (7G), (7F)	18I	Smoothed av. of ranges fr. 3,4,8,78,187,188,190,193, 197,198,212,217,230
27E	Smoothed av. of ranges fr. 8,24,78,101,102,106,107, 113,115,119,130,135,137, 145,146,162,224	10G	Calc. & smoothed fr. (10I), (7G), (7F)		
28E	Smoothed av. of ranges fr. 8,24,78,101,102,106,107, 113,115,119,130,135,137, 145,146,162,224	11G	Calc. & smoothed fr. (11I), (7G), (7F)		
29E	Smoothed av. of ranges fr. 8,24,78,101,102,106,107, 113,115,119,130,135,137, 145,146,162,224	12G	Calc. & smoothed fr. (12I), (7G), (7F)		
30E	Smoothed av. of ranges fr. 8,24,78,101,102,106,107, 113,115,119,130,135,137, 145,146,162,224	8H	Smoothed av. of means fr. 4,5,8,55,165,167,168,169		
31E	Smoothed av. of ranges fr. 8,24,78,101,102,106,107, 113,115,119,130,135,137, 145,146,162,224	9H	Smoothed av. of means fr. 4,5,8,55,167,169		
32E	Smoothed av. of ranges fr. 8,24,78,101,102,106,107, 113,115,119,130,135,137, 145,146,162,224	10H	Smoothed av. of means fr. 4,5,167,169		
33E	Smoothed av. of ranges fr. 8,24,78,101,102,106,107, 113,115,119,130,135,137, 145,146,162,224	11H	Smoothed av. of means fr. 4,5,8,24,55,165,167,168, 169		
34E	Smoothed av. of ranges fr. 8,24,78,101,102,106,107, 113,115,119,130,135,137, 145,146,162,224	12H	Smoothed av. of means fr. 4,8,55,166,169		
35E	Smoothed av. of ranges fr. 8,24,78,101,102,106,107, 113,115,119,130,135,137, 145,146,162,224	8-12I	Smoothed av. of ranges fr. 169,228		
36E	Smoothed av. of ranges fr. 8,24,78,101,102,106,107, 113,115,119,130,135,137, 145,146,162,224	Guinea Pig			
37E	Smoothed av. of ranges fr. 8,24,78,101,102,106,107, 113,115,119,130,135,137, 145,146,162,224	13F	Smoothed av. of means fr. 4,5,7,8,55,68,74,93,99,123, 133,168,188,187,188,189		
38E	Smoothed av. of ranges fr. 8,24,78,101,102,106,107, 113,115,119,130,135,137, 145,146,162,224				
39E	Smoothed av. of ranges fr. 8,24,78,101,102,106,107, 113,115,119,130,135,137, 145,146,162,224				
40E	Smoothed av. of ranges fr. 8,24,78,101,102,106,107, 113,115,119,130,135,137, 145,146,162,224				
41E	Smoothed av. of ranges fr. 8,24,78,101,102,106,107, 113,115,119,130,135,137, 145,146,162,224				
42E	Smoothed av. of ranges fr. 8,24,78,101,102,106,107, 113,115,119,130,135,137, 145,146,162,224				
43E	Smoothed av. of ranges fr. 8,24,78,101,102,106,107, 113,115,119,130,135,137, 145,146,162,224				
44E	Smoothed av. of ranges fr. 8,24,78,101,102,106,107, 113,115,119,130,135,137, 145,146,162,224				
45E	Smoothed av. of ranges fr. 8,24,78,101,102,106,107, 113,115,119,130,135,137, 145,146,162,224				
46E	Smoothed av. of ranges fr. 8,24,78,101,102,106,107, 113,115,119,130,135,137, 145,146,162,224				
47E	Smoothed av. of ranges fr. 8,24,78,101,102,106,107, 113,115,119,130,135,137, 145,146,162,224				
48E	Smoothed av. of ranges fr. 8,24,78,101,102,106,107, 113,115,119,130,135,137, 145,146,162,224				
49E	Smoothed av. of ranges fr. 8,24,78,101,102,106,107, 113,115,119,130,135,137, 145,146,162,224				
50E	Smoothed av. of ranges fr. 8,24,78,101,102,106,107, 113,115,119,130,135,137, 145,146,162,224				
51E	Smoothed av. of ranges fr. 8,24,78,101,102,106,107, 113,115,119,130,135,137, 145,146,162,224				
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■ MORPHOLOGY OF BLOOD LEUKOCYTES AND PLATELETS

Data contributed by Rebuck, J.W.

55. PROPERTIES AND FUNCTIONS OF WHITE BLOOD CELLS AND RELATED FORMS

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Footnotes	Contributors and References
Fn 4	1a
Fn 5	2a
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Contributor (a) Jones, O. ■

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60. BONE MARROW (STERNAL) DIFFERENTIAL CELL COUNT. MAN

Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References
1-31 B	1a	1-31 FG	5a	1-31 KL	8a
1-31 C	2a	1-31 H	6	1-30 MN	9
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All data from Pitts, H. H., & Packham, E. A., Arch Int. Med. 54: 471-482, 1939.

63. BONE MARROW (RIB) DIFFERENTIAL CELL COUNT: DOG

Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References
1-30 BCD	1	1-30 GHI	3	1-30 MNO	5
1-30 EF	2	1-30 JKL	4a		

Contributor: (a) Rekers, P. E.

References: (1) Stasney, J., & Higgins, G. M., Am. J. Med. Sci. 193 462, 1937. (2) Van Loon, E. J., J. Lab. Clin. Med. 28 1575, 1943. (3) Mulligan, R. M., Anat. Rec. 79 101, 1941. (4) Rekers, P. E., & Coulter, M., AEC, Oak Ridge, Tenn., 5-16-49--850--A2111. (5) Mulligan, R. M., Anat. Rec. 91 161, 1945.

64. BONE MARROW (RIB) DIFFERENTIAL CELL COUNT, SUMMARY DOG

References: (1) Stasney, J., & Higgins, G. M., Am. J. Med. Sci. 193 462, 1937. (2) Van Loon, E. J., J. Lab. Clin. Med. 28 1575, 1943. (3) Mulligan, R. M., Anat. Rec. 79 101, 1941. (4) Rekers, P. E., & Coulter, M., AEC, Oak Ridge, Tenn., 5-16-49--850--A2111. (5) Mulligan, R. M., Anat. Rec. 91 161, 1945.

65. MORPHOLOGY OF FORMED ELEMENTS OF BONE MARROW. MAN

Data contributed by Rabuck, J. W.

66. HISTOCHEMICAL PROPERTIES OF BLOOD AND BONE MARROW CELLS. MAN

Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References
1-21 B & Fn 1	13ab	1 E	11ab, 12ab	20 F	5g
22 B & Fn 16	8f, 9f	3 E	11ab, 12ab	21-22 F	12ab
1-3 C	13ab	4 E	2ab 11ab, 12ab, 15ab	1 G	17ab, 3g, 14h
5-22 C	13ab	5 E	11ab, 12ab, 16	2 G	17a, 14h
13 C	16	6 E	2ab, 11ab, 12ab, 15ab	3-4 G	17a, 3g
Fn 7	6c	7 E	11ab, 12ab	5 G	17a, 14h
Fn 8	13ab	8 E	11ab, 12ab	6-7 G	17a
1 D	11ab, 12ab, 8f	10 E	2ab, 11ab, 12ab	8 G	17a
2 D	12ab	11 E	12ab	9 G	17h
3 D	11ab	11 E & Fn 8	11	9 G	17a
4 D	12ab	13 E	11	11 G	17a
5 D	11ab, 12ab	13 E	11	11 G & Fn 13	3g, 14h
8 D	12ab, 2	13 E & Fn 8	12	12 G	3g, 14h
1 D	12ab	15-19 E	11ab, 12ab	13 G	17a
9 D	12ab	20 E	12	14 G	17a, 3g, 14h
11-12 D	11ab, 12ab	20 E & Fn 8	12	15-19 H	17a, 3g, 14h
15-16 D	12ab	22 E	8f, 15	20 G	3g
18-20 D	11ab, 12ab	1-7 F	12ab	21 G & Fn 15	6c
21 D	12ab	9-12 F	12ab	22 G	17a
22 D	8f, 10f, 16f	13 F	12ab, 16	22 G & Fn 17	7c
Fn 14	4d	14-19 F	12ab	2-21 H	1e
					8f

(Continued on the next page)

Contributors: (a) Wislocki, G. B. (b) Bloom, M. L. (c) Lillie, R. D. (d) Gomori, G. (e) Firminger, H. E. (f) Montagna, W. (g) Stowell, R. E. (h) Bacchus, H.

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67. BLOOD WATER AND SOLIDS

Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References
1 B-E	a	9,10 BC	3	18-28 B D	j
2 B-E	1	11-13 B D	3	29 B-E	a
3 B-E	2	14 B-E	a	30 B-E	b
4 BC	1	15 BC	b	31 B D	4c
5-7 B D	3	16 BC	3	32-34 B D	j
8 BC	Calc. fr. (9,10 BC)	17 B D			

Contributors: (a) Manery, J. F. (b) Allison, J. B. (c) Bacchus, H.

References: (1) Hald, P. M., Tulin, M., Danowski, T. S., Lavietes, P. H., and Peters, J. P., Am. J. Physiol. 149: 340, 1947. (2) Miller, A. T., Jr., J. Biol. Chem. 143: 65, 1942. (3) Dukes, H. C., "Physiology of Domestic Animals," Comstock Publishing Co., Ithaca, N. Y., 1942. (4) Bacchus, H., Toompas, C. A., and Heffer, M. H., unpublished data, 1951.

68. BLOOD CARBOHYDRATES AND RELATED SUBSTANCES

Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References
1,2 B-D & Fn 1,2	60a	30,31 B-D & Fn 3,6	2a	59 BD & Fn 3,4,10,14	14a
3,4 BCD & Fn 3,4	58a	32-35 BC & Fn 3,4	59a	60 BD & Fn 3,4,	16a
5 BD & Fn 5,6	45a	36 BCD & Fn 3,11	6a	10,14	
6 BD & Fn 7	27a	37,38 BCD & Fn 3,4	59a	61,62 BC & Fn 3,	16a
7,8 BC & Fn 3,4	59a	39,40 BCD & Fn 5,10	11a	4,10,14	
9,10 BC	32a	41 BCD & Fn 5,10	4a	63 BD & Fn 3,4,	15a
11 B-D & Fn 3,8	7a	42,43 BCD & Fn 3,4	49a	10,14	
12,13 BC & Fn 3,4,7	58a	44 BC & Fn 12	59a	64 BC & Fn 3,4	16a
14,15 B-D & Fn 9	3a	45 BCD & Fn 5,10	50a	65,66 BCD & Fn 3,4,10,14	16a
16 B-D & Fn 5,6	7a	46 BCD & Fn 5,11	41a	67 BC & Fn 4,5	54a
17,18 B-D & Fn 3,4	59a	47 BD & Fn 5,10	61a	68 BD	27a
19 B-D	57a	48 BCD & Fn 5,11	12a	89 BD & Fn 16	4a
20,21 BCD & Fn 5,10	25a	49 BCD & Fn 3,13	46a	10-74 BC & Fn 5,17	33a
22,23 BC & Fn 3,4	59a	50-52 BCD	36a	75-77 BD & Fn 3,13,18	23a
24 BCD & Fn 9	6a	53 BCD	19a	78,79 BCD & Fn 10,19	62a
25 BCD	57a	54,55 BD	33a	80,81 BC & Fn 10,19	62a
26,27 BC & Fn 3,4	59a	56 BC & Fn 12	14a		
28,29 B-D & Fn 3,8	22a	57,58 BC & Fn 3,4,10,14			

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69. BLOOD LIPIDS

Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References
1 B-D & Fn 3	Calc. fr. (2,3 B-D)	45 B-D	4	77 B-D	Calc. fr. (77, 78 B-D)
2 B-D & Fn 1, 2	1a	46 B-D	Calc. fr. (47, 48 B-D)	78 B-D	4
3-7 BCD	2a	47 B-D	6	79 B-D	2a
8 B-D	b	48 B-D	Calc. fr. (25 B-D)	80 B-D	3, 3a
8-11 BCD	2a		and Fn 5	81 B-D	3
12, 13 B-D	1a	49 B-D	b	82 B-D	b
14-16 BCD	2a	50 B-D	10	83-85 BCD	b
19 B-D	Calc. fr. (20, 21 B-D)	51 B-D	b	86 B-D	b
20 B-D	4	52 B-D	Calc. fr. (52, 53 B-D)	87 B-D	2a, 2
21, 22 B-D	2a	53 B-D	4	88 B-D	b
23 B-D	Calc. fr. (24, 25 B-D)	54 B-D	b	89 B-D	b
24 B-D & Fn 4	5a	55 B-D	Calc. fr. (56, 57 B-D)	90 B-D	Calc. fr. (91, 92 B-D)
26-28 BCD	2a	56 B-D	6	91 B-D	4
29 BC	b	57 BC	Calc. fr. (26 B-D)	92, 93 B-D	2, 2a
30, 31 B-D	2a		and Fn 5	94 B-D	3, 3a
32 B-D	Calc. fr. (33, 34 B-D)	58-60 BC	b	95 B-D	a
33 B-D	4	61 B-D	Calc. fr. (62, 63 B-D)	96-99 BCD	2, 2a
34, 35 B-D	2a	62 B-D	4	100 B-D	b
36 B-D	2a	63 B-D	6	101 B-D	2, 2a
37 B-D	Calc. fr. (38, 39 B-D)	64 B-D	3a, 3	102 BC	b
38 B-D	4	65 B-D	5	103 B-D	Calc. fr. (104, 105 B-D)
39 B-D & Fn 5	Calc. fr. (25 B-D)	66-70 BCD	2a	104 BC	4
40 B-D	11	71, 72 B-D	b	105, 106 B-D	2, 2a
41 B-D	b	73 BC	2a	107-118 BCD & Fn 7	Calc. fr. (94, 106 B-D)
42 B-D	2a	74 B-D	b	119-125 BCD	2a
43, 44 B-D	b	75, 76 B-D & Fn 5	7, 7a	126-128 BCD	a

Contributors: (a) Best, C. H. (b) Handler, P. (c) Kirk, J. E.

70. BLOOD PROTEINS. MAN

Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References
1 B	Sum of (2B, 3B), (4B)	2 FG	6	5 FG	Av. of means fr. 1bd, 2g, 3bd, 4bd, 5bd, 6g
1 D	Sum of (2D, 3D)	3 B	Calc. fr. (3D)		
1 F	Sum of (3F, 6F)	3 D	7		
2 B	Calc. fr. 9a, c, 10h, 8e	4 B	Calc. fr. (4F)	6 B	Calc. fr. (6F)
		4 F	Sum of (5F, 6F)	6 FG	12f
2 DE	Calc. fr. 9a, 8e	5 B	Calc. fr. (5F)	Fn 1	6e, 11e, 9a, c, 10h, 8e

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Contributors: (a) Bethell, F. H. (b) Digg, L. W. (c) Drabkin, D. L. (d) Laki, K. (e) Osgood, E. E. (f) Peters, J. P. (g) Stefanini, M. (h) Wintrobe, M. M.

(Continued from preceding page)

References: (1) Gilligan, D. R. and Ernestine, A. C., *Am. J. Med. Sci.* **187**: 552, 1934. (2) Foster, D. P. and Whipple, G. H., *Am. J. Physiol.* **58**, 355, 1922. (3) Gram, H. C., *Acta med. scand.* **55**: 107, 1922. (4) Ham, T. H. and Curtis, F., *Medicine* **17**: 413, 1938. (5) Starlinger, W. and Winands, E., *Ztschr. f. ges. exper. Med.* **50**: 138, 1924. (6) Stefanini, M., *Arch. Sci. Med.* **69**: 177, 1940. (7) Williams, H. H., et al., *Quart. Rev. Biol.* **16**: 80, 1941. (8) Osgood, E. E., *Arch. Int. Med.* **58**: 849, 1933. (9) Bethell, F. H., "Clinical Laboratory Diagnosis and Essentials of Hematology," The Edwards Letter Shop, Ann Arbor, Mich. 1948. (10) Wintrobe, M. M., "Clinical Hematology," Year Book Publishers, 1944. (11) Fonder, E., p. 597 in "Medical Physics," Otto Glasser, Editor, Chicago 1947. (12) Milne, J., *J. Biol. Chem.* **189**: 593, 1947.

71. PLASMA PROTEINS MAN

Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References
1-13 B 1 C 1-11 E 1 F 1-9 H 1 I 1-9 K	Calc. fr. (1-13C) Sum of (2C, 3C) Calc. fr. (1-11F) Sum of (2F, 3F) Calc. fr. (1-9I) Sum of (2I, 3I) Calc. fr. (1-9L)	1-9 L & Fb 3 2 CD FG 2 IL 3-13 CD 3-11 FG	2b Av. of means fr. 3aa, 4g, 5aeg, 6aa, 6ac, 8g 2b 1c 7f	3l 4-9 Li 14 C 14 F 14 J 14 L Fu 1 Fu 2	10d Calc. fr. 10d Calc. fr. (14C 3C) Calc. fr. (4F 5F) 10d Calc. fr. (4L 8L) 11 12,7

Contributors: (a) Digg, L. W. (b) Edsall, J. T. (c) Gutman, A. B. (d) Keys, A. (e) Laki, K. (f) Peters, J. P. (g) Stefanini, M.

References: (1) Gutman, A. B., Moore, D. H., Gutman, E. B., McClellan, V., and Kabet, E. A., *J. Clin. Invest.* **20**, 195, 1941. (2) Armstrong, S. H., Jr., Budka, M. J. E. and Morrison, K. C., *J. Am. Chem. Soc.* **69**, 418, 1947. (3) Gilligan, D. R. and Ernestine, A. C., *Am. J. Med. Sci.* **187**: 552, 1934. (4) Foster, D. P. and Whipple, G. H., *Am. J. Physiol.* **58**: 355, 1922. (5) Gram, H. C., *Acta Med. Scand.* **55**, 107, 1922. (6) Ham, T. H. and Curtis, F., *Medicine* **17**, 413, 1938. (7) Milne, J., *J. Biol. Chem.* **189**, 593, 1947. (8) Starlinger, W. and Winands, E., *Ztschr. ges. exper. Med.* **50**, 138, 1924. (9) Stefanini, M., *Arch. Sci. Med.* **69**, 177, 1940. (10) Taylor, H. L., Michelsson, O. and Keys, A., *J. Clin. Invest.* **28**: 273, 1949. (11) Howe, P. E., *J. Biol. Chem.* **49**, 93, 1921. (12) Major, C. L. H., *J. Biol. Chem.* **169**, 387, 1947.

72. PLASMA PROTEINS. ANIMALS OTHER THAN MAN

Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References
1 F H J *1 G I K 3 F H J *2 C *3 B 3 C 3 D 3 F *3 H J *4 B *4 C *4 D *4 E 4 F	1d 1d 2c 3 2c, 4b 4b 2c 2c (3B) minus (3D) 2c a, 2, 5, 6, 7, 8 9 2c, 10f 10f (4B) minus (4D)	+4 G *4 H J *4 I K 5 B 5 C *5 D *5 H J 6 B 6 D F H J 7 B 7 D 7 E *7 F *7 H J	8 2c 5d (5D) plus (5F) 2c 6 B 2c (6D) plus (6F) 2c (7D) plus (7F) 2c, 11f 11f 2c 2c	8 B 8 DE *8 F 9 F H J *9 G *10 F *10 H J 11 B 11 D *11 E 11 F H J *12 G I K 12 B D F H J 13 F H J	(8D) plus (8F) f 8 12d 13d 2c, 13d 2c, 13d (11D) plus (11F) 14 14 15de 15de 2c 2c

Note:
*Calculated from standard deviation from reference(s) indicated.
**Average of means from reference(s) indicated.
***Calculated from A/G ratio from reference(s) indicated.
+Range interval from reference(s) indicated.
++Calculated from average A/G ratio from reference(s) indicated.

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Contributors. (a) Allison, J. B. (b) Brody, S. C. (c) Howe, P. E. (d) Leatham, J. H. (e) Seibert, F. D. (f) Stefanini, M.

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- References (1) Levin, L., Leatham, J. H., and Crafts, R. C., *Am. J. Physiol.* **136**, 776, 1942. (2) Howe, P. E., *Physiol. Rev.* **5**, 439, 1925. (3) Herrmann, G. R., *Proc. Soc. Exp. Biol. Med.* **61**: 229, 1946. (4) Brody, S., et al., *Univ. Missouri Agr. Exp. Sta. Res. Bull.* **433**, 1949. (5) Elman, R., Sachar, L. A., Horvitz, A., and Wolf, H., *J. Lab. and Clin. Med.* **27**: 1183, 1942. (6) Little, J. M., and Dameron, J. T., *Am. J. Physiol.* **140**, 636, 1945. (7) Danowski, T. S., Winkler, A. W., and Elkinton, J. R., *J. Clin. Invest.* **28**, 887, 1947. (8) Drinker, C. K., and Yoffey, J. M., "Lymphatics, Lymph, and Lymphoid Tissue," Harvard University Press, Cambridge, Mass., 1941. (9) Helm, J. W., *Am. J. Physiol.* **103**, 553, 1933. (10) Foster, D. F., and Whipple, G. H., *Am. J. Physiol.* **58**, 365, 1922. (11) Fréderick, *Récherches sur la coagulation du sang*, Gand, Paris, Leipzig, 1878. (12) Dougherty, T. F., and White, A., *Endocrinology* **33**: 370, 1948. (13) White, A., and Dougherty, T. F., *Endocrinology* **25**: 207, 1945. (14) Henriques, S. B., Henriques, O. B., and Selye, H., *Proc. Soc. Exp. Biol. Med.* **71**: 82, 1949. (15) Moore, D. H., Levin, L., and Smelser, G. K., *J. Biol. Chem.* **157**, 723, 1945.

73. PLASMA PROTEINS, CERTAIN PROPERTIES AND REACTIONS. MAN

Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References
1-28AB 7-11, 17-25C 2-14, 19-26, 28D	c c, 1, 2 1	1-10, 17-21, 25E 26E Fn 1 Fn 2, 3	c a 3b, 4b, 5b, 6b, 7b a

Contributors: (a) Edsall, J. T. (b) Gurd, F. R. N. and Brown, R. K. (c) Strong, L. E.

- References: (1) Cohn, E. J., et al., *J. Am. Chem. Soc.* **72**, 465, 1950. (2) Krebs, H. A., *Ann. Rev. Biochem.* **19**, 405, 1950. (3) Shinowara, G. Y., Jones, L. M., and Reinhard, H. L., *J. Biol. Chem.* **142**, 921, 1942. (4) Somogyi, M., *J. Biol. Chem.* **125**: 399, 1938. (5) Ambard, L., *Bull. Soc. Clin. Biol.* **3**: 51, 1921. (6) Adams, D. H., and Whittaker, V. P., *Biochem. J.* **44**, 67, 1949. (7) Talalay, P., Fishman, W. H., and Huggins, C., *J. Biol. Chem.* **186**, 737, 1946.

74. PLASMA PROTEINS, PHYSICAL PROPERTIES. MAN

Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References
1 B 2, 3 B 4, 5 B	3 3: 2 quoted by 4a 1, 2 quoted by 3 & by 4a	8, 9 C 11, 12 C 13 C 14 C 17 C 18 C 20 C 21 C 22 C 26, 27 C 28 C 29 C 30-32 C 2 D 3 D 4-10 D 11, 12 D 17-18 D 20-22 D 26, 27 D 29 D	1 1 1 1, 3 1 1, 3 1 1, 3 8 quoted by 1 1 10 quoted by 1 1, 3 1 5 quoted by 1 1 1, 3 1 1, 3 1 1, 3 1 1, 3	32 D 33 E 4, 5 E 7 E 18 E 26, 27 E 3 F 4, 5, 7-9, 17, 18, 20F 21 F 26 F 27, 30, 31 F 32 F 4, 5 G 5 H, 18, 26, 27 G 4 H 7, 10, 26, 27 H 3, 4, 18, 26, 27 I 5, 4, 7, 18, 26, 27 JK Fn 2	1 1 quoted by 4a 2 quoted by 4a 2 quoted by 4a 2 quoted by 3 & by 4a 2 quoted by 3 2 quoted by 3 1 6 quoted by 1 7 quoted by 1 1 11a 2 quoted by 4a 2 quoted by 3 2 quoted by 4a 2 quoted by 3 & by 4a 2 quoted by 3 2 quoted by 4a 2 quoted by 4a 11a

Contributors (a) Edsall, J. T. (b) Strong, L. E.

- References: (1) Cohn, E. J., et al., *J. Am. Chem. Soc.* **72**, 465, 1950. (2) Oncley, J. L., *Experientia*, **3**, 189, 1947. (3) Brand, E., and Edsall, J. T., *A. J. Phys. Colloid. Chem.* **51**, 184, 1947. (4) Cohn, E. J., *Ann. Rev. Biochem.* **16**, 223, 1947. (5) Morrison, P. R., Edsall, J. T., and Miller, S. G., *J. Am. Chem. Soc.* **70**, 3101, 1948. (6) Surgenor, D. M., et al., *J. Am. Chem. Soc.* **71**, 1223, 1949. (7) Cohn, E. J., *Bull. N.Y. Acad. Med.* **75**, 639, 1939. (8) Surgenor, D. M., and Ellis, D., *Acta Chem. Scand.* **1**, 946, 1947. (9) Holmberg, C. G., and Laurell, C. B., *Abstracts First Internat. Cong. Biochem. Camb., Eng.*, No. 291-B, *Acta Chem. Scand.* **1**, 946, 1947. (10) Hughes, W. L., Jr., *Spring Harbor Symposia Quarta Biol.* **24**, 79, 1949. (11) Schmid, K. J., *Nature* **161**, 236, 1948. (12) Schmid, K. J., *Am. Chem. Soc.* **72**, 2816, 1950.

75. BLOOD FREE AMINO ACIDS

Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References
1 B-H & Fh 4	6a, c	26 B GH	d, l	51 B GH	d, l
2 B GH	9e	27 B-H	21c	52 B H	3c
3 B-D	10a	28 B-D GH	12a	53 B GH	9e
4 B-H	11ac	29 B GH	9e	54 B GH	21c
5 B-H	11a, 12a	30 B GH	d, l	55 B-H	21c
6 B GH	9e	31 B-H	21c	56 B-D GH	12a
7 B GH	1b	32 B-D GH	12a	57 B GH	9e
8 B H	3c	33 B GH	9c	58 B GH	d, l
9, 10 B H	8a, c	34 B GH	d, l	59 B-H	1bac
11 BC E G	13a	35 B GH	12a	60 B GH	17a
12 B-H	21c	36 B GH	12ad	61 B-D GH	12a
13 B GH	12a	37 B GH	9e	62 B G	19g
14 B G	13a	38 B GH	d, l	63 B GH	18a, 9e
15 B H	14a	39 B-H	21c	64 B GH	18a
16 B H	14a	40 B GH	12a	65 B-D GH	d, l
17 B H	14a	41 B GH	20g	66 B GH	18a
18 B GH & Fh 7, 8	15a, f	42 B GH	9e	67 B-G	21c
19 B G	2	43 B GH	d, l	68 B-D GH	12a
20 B G	8a	44 B-H	21c	69 B GH	20g
21 B GH	9e	45 B-D GH	12a	70 B GH	9e
22 B E-H	6a	46 B GH	9e	71 B GH	1d
23 B D	df, sf, 6a, 7f	47 B GH	d, l	72 B-H & Fh 20	d, l
24 B G	6a	48 B-H	21c	73 B-D GH	12a
25 B GH	9e	49 B-D GH	11a, 12a	74 B GH	9e
26 B G	6a	50 B GH	9c	75 B GH	d, l

Contributors (a) Beerstecher, E., Jr., and Spangler, S. (b) Williams, J. N., Jr. (c) Bergsm, O. (d) Hier, S. W. (e) Steele, B. F. (f) Hamilton, P. H. (g) Schweigert, B. S.

References: (1) Henderson, L. M., et al., *J. Biol. Chem.* **177** 815, 1949 (2) Bessman et al. *J. Biol. Chem.* **177** 815, 1949 (3) Steele, B. F., Reynolds, N., and Lynch, E. L., *J. Biol. Chem.* **168** 1, 1948 (4) Lynch, E. L., *J. Biol. Chem.* **168** 1, 1948 (5) Gutman, G. E., Landwehr, G., *Chem.* **154** 643, 1944 (6) Steele, B. F., *J. Biol. Chem.* **177** 815, 1949 (7) von Euler, H., *J. Biol. Chem.* **177** 815, 1949 (8) Sullivan, T. S., and Lill, G. L., *J. Dairy Sci.* **37** 181, 1948 (9) Schweigert, B. S., et al., *J. Biol. Chem.* **164** 213, 1946 (10) Schweigert, B. S., Pearson, P. B., and Wicking, M. C., *Arch. Biochem.* **12** 139, 1947 (11) Schweigert, B. S., unpublished data (12) Johnson, C. A., and Bergsm, O., *J. Biol. Chem.* **188** 683, 1951

Data Coordinates and Footnotes	Contributors
1 B-D	
2 B-D	
3 B-D	
4-6 BCD & Fh 6, 7, 8	
7 BC	13, 14
8 B-D	10c
9, 10 B-D & Fh 9, 10	14b, 15b
	12-13 BC
	14 BC
	15 B-D
	16 BC

Contributors (a) Beerstecher, E., Jr., and Spangler, S. (b) Looney, J. M. (c) Williams, J. N.

References: (1) Heller, *Endocrinology* **42** 164, 1948 (2) Krebs, R. A., *Ann. N.Y. Acad. Sci.* **51** 1385, 1947 (3) Perle, J., *J. Lab. Clin. Med.* **30** 706, 1945 (4) Morgulis, S., and Lab, *Biol. Med.* **31** 413, 1944 (5) Phila., 1944, p. 426 (6) Biot. Chem. **51** 121, 1924 (7) Jellinek, J., *Chem.* **60** 85, 1938

77. NITROGEN CONTENT OF BLOOD NITROGEN COMPOUNDS

References: All values are calculated from molecular weights and formulae as presented in "Handbook of Chemistry and Physics," Hodgman, C. D., Editor, Chemical Rubber Publishing Co., Cleveland, 1946, except those for items 9, 11, 21, 42, 46, 50, and 51 which were calculated from data in "Human Biochemistry," Kleiner, I. S., C. V. Mosby and Co., St. Louis, 1948.

78. BLOOD PHOSPHORUS, INORGANIC

Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References
1-3 ABC & Fn 2	6	10 A-C & Fn 4	2a	17 A-C & Fn 4	2
4 AB & Fn 3	3	11 A-C & Fn 4	2	18 A-C & Fn 4	2
5 A-C & Fn 4	2a	12 AB & Fn 3	3	19 A-C & Fn 6	5a
6 A-C	2a	13 AB & Fn 3	3a	20 AB & Fn 3	3
7 A-C	5a	14 AB & Fn 3	3	21 AB & Fn 3	3a
8 AB & Fn 3	3	15 AB	3	22-24 A-C & Fn 3	5a
9 A-C & Fn 4	a	16 A-C & Fn 4	2	25-40 AB & Fn 3	3

Contributor: (a) Freeman, S.

References: (1) Brain, Kay and Marshall, Biochem. J. 22:628, 1928. (2) Kay, J. Physiol. 65:374, 1928. (3) Guest, G. M. and Rapoport, S., J. Biol. Chem. 138:269, 1941. (4) Rapoport, S. and Guest, G. M., J. Biol. Chem. 126:749, 1938. (5) Freeman, S. and Farmer, C. J., Am. J. Physiol. 113:200, 1935. (6) Helve, Acta Med. Scand. 125:505, 1946.

79. BLOOD PHOSPHORUS, ORGANIC ACID-SOLUBLE

Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References
1,2 ABC & Fn 2	1a	15,16 AB & Fn 3	3	30 AB & Fn 3	3
3,4 AB & Fn 3	3	17-19 AB & Fn 4	2	31,32 AB & Fn 4	2
5 ABC	3a	20 AB & Fn 4	2a	33-36 AB & Fn 3	3
6-8 AB & Fn 3	3a	21-24 AB & Fn 4	2	37-40 AB & Fn 4	2
9,10 AB & Fn 4	2	25,26 AB & Fn 3	3	41-44 AB & Fn 3	3
11,12 AB & Fn 3	3	27,28 AB & Fn 3	2	45,46 AB & Fn 4	2
13,14 AB	3a	29 AB & Fn 3	3a	47,48 AB & Fn 3	3
				49-60 AB & Fn 4	2

Contributor: (a) Freeman, S.

References: (1) Helve, Acta Med. Scand. 125:505, 1946. (2) Rapoport, S. & Guest, G. M., J. Biol. Chem. 138:269, 1941. (3) Kerr, S. E., & Daoud, L., J. Biol. Chem. 109:301, 1935.

80. BLOOD ADENOSINE TRIPHOSPHATE PHOSPHORUS

Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References
1,2 A-C & Fn 2	1	25,26 AB	1	39-42 ABC & Fn 2	1
3,4 AB & Fn 2	1	27,28 AB & Fn 2	1	43,44 ABC & Fn 2	1
5-8 AB & Fn 2	1a	29,30 AB & Fn 2	1	45,46 ABC & Fn 3	2
9,10 AB & Fn 3	2	31,32 AB & Fn 3	2	47,48 AB & Fn 2	1
11,12 AB & Fn 3	1	33,34 AB & Fn 2	2	49-52 AB & Fn 3	2
13,14 AB	2	35,36 AB & Fn 2	1	53-56 ABC & Fn 3	2
15,16 AB & Fn 2	1	37,38 AB	2	57-60 AB & Fn 3	2
17-24 AB & Fn 3	2				

Contributor: (a) Freeman, S.

References: (1) Kerr, S. E., & Daoud, L., J. Biol. Chem. 109:301, 1935. (2) Guest, G. M., & Rapoport, S., J. Biol. Chem. 138:269, 1941.

81. BLOOD DIPHOSPHOGLYCERATE PHOSPHORUS

Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References
1,2 A-C & Fn 3	1a	13,14 AB & Fn 4	1	20 A-C	2
3-5 AB & Fn 4	2	15 AB & Fn 4	2	21-27 AB & Fn 4	2
6 A-C & Fn 4	2	16 A-C & Fn 4	2	28 A-C & Fn 4	2
7-12 AB & Fn 4	2	17-19 AB & Fn 4	2	29-36 AB & Fn 4	a

Contributor: (a) Freeman, S.

References: (1) Helve, Acta Med. Scand. 125 505, 1946. (2) Guest, G.M., & Rapoport, S., J. Biol. Chem. 138 269, 1941.

82. BLOOD NUCLEOTIDE PHOSPHORUS

All data from Kerr, S. E. and Daoud, L., J. Biol. Chem. 107 301, 1935.

83. BLOOD LIPID PHOSPHORUS

Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References
1,2 AB & Fn 1	1b	5 AB & Fn 1	3	7 A-C & Fn 1	4a
3 A-C	2	6 A-C & Fn 2	6a	8 A-C & Fn 1	5a
4 AB & Fn 1	1b	6 AB & Fn 3	7a		

Contributors (a) Flock, E.V. (b) Stearns, G

References (1) Stearns, G. & Warweg, E., J. Biol. Chem. 102 749, 1933. (2) Page, Kirk, Lewis, Thompson & Van Slyke, D.D., J. Biol. Chem. 121 613, 1935. (3) Sinclair, R.G., J. Biol. Chem. 174 343, 1948. (4) Bollman, J.L. & Flock, E.V., J. Lab. Clin. Med. 31:478, 1946. (5) Flock, E.V. & Bollman, J.L., J. Biol. Chem. 144 571, 1942. (6) Baumann, E.J., & Holly, O.M., J. Biol. Chem. 51 457 1923. (7) Artom, C., & Freeman, J.A., J. Biol. Chem. 135 59, 1940.

84. BLOOD HEXOSE PHOSPHATE PHOSPHORUS

All data from Helve, Acta Med. Scand. 125:505, 1946.

85. BLOOD PHYTIC ACID PHOSPHORUS

All data from Guest, G. and Rapoport, S., J. Biol. Chem. 138 209, 1941

86. BLOOD SULFUR

Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References
1-5 BCD	3a	10 BC	1	14 B-D & Fn 1	a, 1a
6,7 BC	2b	11,12 B-D	3a	15-17 BC	2b
8 BC	1	13 BC	2b	18-20 BCD	3a
9 BC	2b				

Contributors. (a) Lewis, H.B. (b) Ponder, E

References (1) Power, M.H., & Wakefield, E.G., J. Biol. Chem. 123 669, 1938. (2) Reed, L., & Denis, W., J. Biol. Chem. 73 191, 623, 1927. (3) Brown, B.H. & Lewis, H.B., J. Biol. Chem. 138 705, 1941

87. BLOOD SULFUR COMPOUNDS

Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References
1-3 BCD	7a	16 BC	6c	27 BC	Calc.fr. (26 BC)
4, 5 BC	Calc.fr. 1	17 BC	Calc.fr. (18, 19 BC)	29 B-D	11a
6 B-D	7a		4b, 5b	30 B-D	Calc.fr. (29 BC)
7 BC	7a	18, 19 BC	10a	31 BC	5b
8, 9 B-D & Fn 1	7a	20 BC	Calc.fr. (20 BC)	32 BC	Calc.fr. (33, 34 BC)
11, 12 B-D & Fn 3	a	21 BC	6c	33 BC	4b, 5b
13 BC	6c	22 BC	2c	35 BC	10a
14 B-D	Calc.fr. (15, 16 B-D)	24, 25 BC	4b, 5b	36 BC	Calc.fr. (35 BC)
15 B-D	5a	26 BC	10a	38-42 BCD	3c

Contributors (a) Lewis, H. B. (b) Looney, J. M. (c) Wood, J. L.

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88 BLOOD VITAMINS

Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References
1 B-D GH	22a, 26a, 71a	43 B H & Fn 3	30a	75 B-D & Fn 6,	1a, 41a, 50a
1-15 E & Fn 2	55a	44 B G & Fn 3	30a	7, 13	
2 B-D GH	4a, 32a, 34a, 37a, 60a	45 BC & Fn 3	52a	76 B C & Fn 6, 7	50a
3 B-D GH	2a, 5a	46 B G & Fn 3	30a	77 B C & Fn 6, 7	1a, 41a, 50a
4 B-D GH	49a	47 B-D F H & Fn 1	30a, 58a	78 B-D & Fn 6	63a
5 B-D GH	21a	48 B GH & Fn 1	30a	79 B-D & Fn 6, 7	1a, 41a, 48a, 50a
6 B-D GH	20a, 81a	49 B H & Fn 1	31a	80 B-D & Fn 4,	23
7 B-D GH	17a	50 B H & Fn 2	25a	6, 7	
8 B-D G	45a	51-52 B G & Fn 1	30a	81 B-D & Fn 6	44a, 62a, 66a
8 H	24a	53 B G & Fn 1	25a	81 B EF & Fn 6	42a
9 B-D G	82a	54 B H & Fn 1	25a	81 B GH & Fn 6	42a, 59a, 83a
10 B-D GH	26a	55 B G H & Fn 1	30a, 31a	82 B-H & Fn 6	83a
11 B-D G	34a	56 B G H & Fn 2, 3	76a	83 B-H & Fn 6	a
11 H	40a	57 B E G & Fn 3	74a	84 B-H & Fn 6	a
12 B-D GH	49a	58 B G & Fn 2, 3	75a	85 B-H & Fn 6	a
13 BC	21a	59-61 B GH & Fn 1	75a	86 B-H & Fn 6	42a, 48a
14 B-D GH	45a	62 B GH & Fn 1	75a	87 B-D & Fn 6	16a, 43a
15 B-D G	82a	63 B GH & Fn 1, 2	46a, 67a, 71a	88-89 BC & Fn 1	52a
15 H	11a, 82a	64 B GH & Fn 1	13a, 14a, 46a	90 BC & Fn 1, 2	60a
16 B-D	39b	65 B GH & Fn 1	61a	90 B-D G & Fn	10a
16 E	56a	66 B GH & Fn 1	79a	1, 2	
16 GH & Fn 3	33a, 56a	67 B H & Fn 1	55a	90 B H & Fn 1, 2	10a, 60a
17 B-D GH & Fn 3	3a, 34a	68 B GH & Fn 1	79a	91 B D H & Fn	60a
18 B-D GH & Fn 3	35a, 49a	69 B GH & Fn 5	65a	1, 2	
19 B-D GH & Fn 3	21a	70 BC & Fn 5	52a	92 B D H & Fn	60a
20 B-D GH & Fn 3	35a, 84a	71 B-D & Fn 6-9	28a, 47a, 54a	1, 2	
21 B-D GH & Fn 3	70a	71 B E & Fn 6,	27a	93 B-D & Fn 1, 2	42a, 48a
22 B C G	49a	7, 10		94 B D H & Fn	60a
22 B D H	57a	71 B GH & Fn 6, 7	8a, 29a, 38a	1, 2	
23-37 B-D & Fn 4, 7	9	72 B C & Fn 6, 7	80a	95 B-D & Fn 1	60a
38 B-D GH & Fn 3	10a	73 B-E & Fn 6,	1a, 41a, 50a	96 B-D G & Fn 1	60a
39-40 BC & Fn 3	52a	7, 10		97 B-D G & Fn 1	60a
41 B H & Fn 3	30a	73 D-E & Fn 6	27a	98 B-D G & Fn 1	60a
42 B D & Fn 3	77a	74 B D & Fn 6, 12	1a	99 B-D G & Fn 1	60a
42 B G & Fn 3	30a			100 B-D G & Fn 1	60a

(Continued on the next page)

Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References
1 BC & Fn 2	a	11 BC & Fn 18	20eb, 12g, 7g	43 BC	b, 18e
2 BC & Fn 2	b	24 BC	h	44 BC & Fn 31	17e
3-4 B D & Fn 4	30dc	25 BC	8, 8e	45 BC	18e
5 B-D	1e	26 B D	8, 8e	46 BC	21e
Fn 5	11	27 BC	b	47 B D & Fn 32	23jk
6 B D & Fn 6	f	28 BC	9e	48 B D & Fn 32	19g
7-10 B D & Fn 7	2	29 BC	10e, g	49-50 B D & Fn 33	22j
11 BC & Fn 7, 38	3, 3c	30 BC	6, 6e	51 B D & Fn 32	26k
12 B D	h	31 B D & Fn 21	32 h	52 B D & Fn 32	24
13 B D	i	32-34 BC	b	53-55 B D & Fn 33	26k
14 BC	4c	Fn 22	11	56 B D & Fn 34	25e
15-16 BC & Fn 9,	3cg	35 BC	12e	57 B D & Fn 35	25
10, 11, 12		36 BC & Fn 25-28	13ei	58 BC & Fn 34	27m
17 BC & Fn 14	5	37 B D & Fn 29	i	59 B D	b
18 BC	5g	38-40 BC & Fn 30	13i	Fn 37	26m
19-21 & Fn 13-15	5	41 BC & Fn 27, 30	15e	Fn 40	28n
22 BC	6, 6e	42 BC & Fn 27	14	Fn 41	33o

Contributors: (a) Sayers, G. (b) Roberts, S. (c) Catchpole, H. (d) Hilmer, P. E. and Hess, W. (e) Zarrow, M. X. (f) Venning, E. (g) Bischoff, F. (h) Von Euler, U. S. (i) Forbes, T. R. (j) Chaikoff, I. L. (k) Hansel, W. (m) Paschke, K. E. (n) Asdell, S. A. (o) Samuels, L. T.

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ocrinology 1: 689, 1944. Proc. Soc. Exp. Biol.ocrinology 40 47, 1945. Press, 1950 pp. 228. Walking, and Boyle, E Hilmer, P. E., and He (32) Von Euler, U. S., and Kaindi, 1951. (33) Samuels, L. T., unpublished data.

90. BLOOD ENZYME ACTIVITY

Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References
1 A-C, 4 A-C & Fn 1, 3	6e	30-32 ABCD & Fn 11	21n	102, 103 A-D & Fn 21	24e
2, 3 A-D & Fn 2	17jk	33-40, 43, 44 A-D, & Fn 12	11n	104, 105 ABC	dj
5-8 ABCD & Fn 4	22j	42 A-C	20n	106 A-D & Fn 22	26m
9 A-D & Fn 5	23j	45-92 ABC	21n, 12in, 19in	107 A-C	28h
10-17 ABCD & Fn 6	16j	93 A-D & Fn 11	18j	108 A-D & Fn 21	14j
18-26 ABCD & Fn 7	1ja	94 A-C	27h	109 A-D & Fn 24	10ig
27 A-C & Fn 8	13c	95, 96 A-D & Fn 19	8j	110-112 ABCD	3jo
28 A-D & Fn 9	7j	97-100 ABCD & Fn 20	5j	113 A-D & Fn 29	6f
29 A-D & Fn 10	4b	101 A-C	27h	114 A-D & Fn 30	25

Contributors: (a) Altschule, M. (b) Brody, S. (c) Chance, B. (d) Denstedt, O. (e) Dische, Z. (f) Cuest, M. M. (g) Cutman, A. B. (h) Horecker, B. L. (i) Koele, G. B. (j) Lehninger, A. (k) Meister, A. (m) Rossiter, R. (n) Sabine, J. C. (o) Sizer, I.

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- (7) Dille, R. S., and Watkins, C. H., *J. Lab. Clin. Med.*, **33**, 480, 1948. (8) Fishman, W. H., Springer, and Brunetti, J., *Biol. Chem.* **173**, 449, 1948. (9) Guest, M. M., Ware, A. G., and Seegers, W. H., *Am. J. Physiol.* **150**, 661, 1947. (10) Gutman, E. B., and Gutman, A. B., *J. Biol. Chem.*, **136**, 201, 1940. (11) Hall, G. E., and Turner, J., *J. Pharmacol.* **61**, 10, 1937. (12) Hawkins, R. D., and Mendel, B., *J. Biol. Chem.*, **136**, 201, 1940. (13) Huggins and St. 201, 1948. (14) Huggins and St. 276, 1948. (15) Kochakian, C. D., *J. Biol. Chem.*, **136**, 201, 1940. (16) Kochakian, C. D., *J. Biol. Chem.*, **136**, 201, 1940. (17) Meister, A., *Science* **106**, 1948. (18) Meister, A., *J. Nat. Cancer Inst.*, **5**, 163, 1948. (19) Meister, A., *J. Nat. Cancer Inst.*, **5**, 163, 1948. (20) Meister, A., *J. Nat. Cancer Inst.*, **5**, 163, 1948. (21) Meister, A., *J. Nat. Cancer Inst.*, **5**, 163, 1948. (22) Meister, A., *J. Nat. Cancer Inst.*, **5**, 163, 1948. (23) Meister, A., *J. Nat. Cancer Inst.*, **5**, 163, 1948. (24) Meister, A., *J. Nat. Cancer Inst.*, **5**, 163, 1948. (25) Meister, A., *J. Nat. Cancer Inst.*, **5**, 163, 1948. (26) Meister, A., *J. Nat. Cancer Inst.*, **5**, 163, 1948. (27) Meister, A., *J. Nat. Cancer Inst.*, **5**, 163, 1948. (28) Meister, A., *J. Nat. Cancer Inst.*, **5**, 163, 1948.

91. BLOOD COENZYMES

Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References
1 A-E	2	5-17 ABCDE	a	20 A-E	a
2-4 ABCDE	1c	& Fn 2		21-23 ABCDE	4b
& Fn 1		18, 19 A-E	3b	& Fn 3	

Contributors (a) Beersbacher, E., and Spangler, S. (b) Granich, S. (c) Lehninger, A.

References (1) Goodhart, R. S., and Sinclair, M. M., *Biochem. J.*, **31**, 1099, 1939. (2) Kaplan, M. O., and Lipmann, F., *J. Biol. Chem.*, **174**, 37, 1948. (3) Klein, J. R., and Kohn, H. L., *J. Biol. Chem.*, **136**, 177, 1940. (4) Levitas, N., Robinson, J., Rosen, F., Hull, J. W., and Perlzweig, W. A., *J. Biol. Chem.*, **167**, 169, 1947.

92. BLOOD ELECTROLYTES

Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References
1 BCD	41f, 42f	19 BCD	6	76 BCD	10e
2, 3 BCD & Fn 2, 3	15h, 16h, 15h	40 BC	29e, 53e	79 BCD	10c, 12c
4 BCD & Fn 2, 3	21	41 BCD	53e	80 BCD	31e
5 BCD	Calc. fr 6, 7 BCD	42 BCD	7d, 8d	81 BCD	Calc. fr 82, 83 BCD
6 BCD & Fn 3	9d	43, 44 BCD	32e	82 BCD	10c
7 BCD & Fn 3	11g, 25g, 35g	45, 46 BCD	4b	83 BCD	5e
8 BCD & Fn 3	3d, 7d, 8d, 9d	47 BCD	31d	84 BCD	31d
9-11 BCD & Fn 3	11g, 25g, 35g	48 BCD	24e	85 BCD	20e
12 BC & Fn 4	4b	49 BC	25e	86 BCD	10c, 12c
13 BC	40f	50 BCD	Calc. fr 51, 52 BCD	87 BCD	20e
14 BCD	31d	51 BC	43e	88 BC	Calc. fr 89, 90 BC
15 BCD	Calc. fr 16, 17 BCD	52 BCD	20a	89, 90 BC	10c
16, 17 BCD & Fn 3	g	53 BC	Calc. fr 54, 55 BCD	91 BC	Calc. fr 92, 93 BC
18 BCD	41f, 42f	54, 55 BC	7c, 12c	92, 93 BC	28e
19, 20 BCD & Fn 3	16h, 17h	56 BCD	20e	94 BC	Calc. fr 95, 96 BC
21 BCD	6d	57, 58 BCD	10c, 12c	95, 96, 98, 99 BC	10c
22 BCD	Calc. fr 23, 24 BCD	59 BC	Calc. fr 60, 61 BCD	97 BC	Calc. fr 98, 99 BC
23 BCD	9d	60 BC	7c, 12c	100 BC	2c, 22c
24 BCD	11g, 25g, 35g	61 BCD & Fn 2	4b	101 BCD	27f
25 BC	19e	62 BCD	7d, 8d	102, 103 BC	32f
26-28 BCD	11g, 25g, 35g	63 BC	Calc. fr 64, 65 BC	104-109 BC	11
29 BC & Fn 3	4b, 4e	64 BC	10c, 10f	110 BCD	42f, 44f
30 BCD & Fn 3	5	65 BC	10c, 10f	111, 112 BC	15h
31 BCD	31d	66, 67 BC	28f	113, 114 BCD	15h
32 BC	36e	68 BC	38f	115 BCD	Calc. fr 116, 117 BCD
33 BCD	Calc. fr 34, 35 BCD	69 BC	Calc. fr 70, 71 BC	116 BCD	9d
34, 35 BCD	34g	70, 72, 76 BCD	10c, 12c	117 BCD & Fn 8	30a
36 BC	36e	71, 73, 74 BC	10c	118-120 BCD	25g
37 BC	26e	75 BCD	20e	121 BC & Fn 9	4b
38 BCD	18e	77 BCD	10c, 12c		

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Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References
122 BC	40d	127 BC	4b	132 BC	46c
123 BCD	g	128 BC & Fn 11	5	133 BCD	5
124, 125 BCD & Fn 10	15h	129 BCD	6d	134 B D	39
126 BCD & Fn 10	30a	130 BCD	29e	135 BC	30g
		131 BCD	45e	136-138 BCD	g

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83. BLOOD MINOR MINERALS

Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References
1-3 BCD	11e	21, 22 B-D	21b	34 B-D	2a
4 B D	5	23 B-D	3, 4, 14, 15, 16, 25b	35 BC	8a
5-7 BCD	7a	24 B-D	19c	36-38 BCD	11e
8, 9 B D	1b	25, 26 B-D	22b	39, 40 BC	23
10 BC	14b	27 BC	10b	41-43 BCD	11a
11-13 BCD	20b	28, 29 B-D	22b	44 BC	21b
14 B-D	2a	30 B-D	9, 18d	45 B-D	12b
15, 16 B-D	20b	31 B-D	17c	46 BC	26b
17 BC	6b	32 B-D	19	47, 48 BC	12b
18-20 BCD	13c	33 B-D	8a	49, 50 BC	26b
				51-54 BCD	11e
				55-58 BCD	24

Contributors: (a) Cartwright, G. E. (b) Levine, V. E. (c) Peters, J. H. (d) Peters, J. P. (e) Largent, E. J.

(Continued on the next page)

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94. BLOOD GASES MAN

Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References
Fa 1,2 1,2 A & Fa 3 1,2 B Fa 6 1,2 E Fa 8 3-8 ABCDEF	m 1n,2n, 13e k, 4k 3, 4k (1B) k (7-10 ABCDEF & 11-14 ABCDEF) Av. of 5d, 8h, 11h, 12h, 13e, 18ehm, 18h, 27j, 28j Av. of 5d, 6ch, 7ch, 8h, 8chj, 10ch, 11h, 12h, 13el Av. of 47f, 48f, 49f (15, 14H) & 50hk Av. of 5d, 13el, 11h (7-10 EF) (7-10 GH) (7, 4 G) (5, 6G) 14c (1, 2 B & 11, 12H) (11, 12B & 12, 12C) (11, 12C) (11, 12D) (3, 4G) Av. of 15chj, 16ehm, 17c, 8h (13, 14B & 13, 14H) (13, 14B & 13, 14C) (13, 14C) (13, 14D)	13, 14 G 13, 16 H 15 AB 16AB & Fa 17 15, 16 C 15, 16 D 15, 16 E 15, 16 F & Fa 15 15 G 16G Fa 18 Fa 19 15, 16 H 15, 16 I 17, 18 AB 17, 18 C 17, 18 D 17, 18 E 17, 18 F 17, 18 G 17, 18 H 19-22 ABCD 19-22 E 19-22 F 19-22 G	(5, 6G) (1, 2B, 13, 14B) & 51hk Av. of 5d, 25g, 31g, 27j, 28j, 17f, 21g, 19a, 45g, 46g, 26g (15 AB) & 25k (15, 16B & 15, 16D) (15, 16F) (15, 16C) (15, 16B & 15, 16H) Av. of 5d, 25g, 31g, 6h, 7h, 12g, 8h, 34h, 27j, 11h, 12h, 28j, k, 10j, 19a, 21g, 45g, 46g, 26g (16F & 24f & Fa 1a) 32m, 25m 33m 22m, 23m, 24m 30m (3, 4f & Fa 1a) (15, 16B & 15, 16I) (17, 18B, 17, 18D) (17, 18F) (17, 18C) (17, 18B & 17, 18H) (17, 18F & 25, 26f & Fa 19) (15, 16H) (19-22E, F) (19-22G, H) (19-22G, I) (15-18G)	19-22 HI & Fa 20 23-26 ABCDEF 23-26 G 23-26 H 23 I 24 I 25 I & Fa 21 26 I 27-30 AB 27-30 C 27-30 D 27-30 E 27-30 F 27-30 G 27-30 HI & Fa 22 21-34 ABCDEF 35-38 AB 35-38 C 35-38 D 35-38 E 35-38 F 35-38 G & Fa 23 35-38 HI & Fa 24	20m, 21m (15-18 ABCDEF & 19-22 ABCDEF) (15-18G) 21k Av. of 5d, 8h, 12h, 18h, 21gm, 25g, 28g, 27j, 28jm, 39m, 40m, 42m, 43m, 45g, 46g, m (23f & Fa 8) 25g k (26F & 26 G & Fa 19) k (27-30C & 27-30D) (27-30E) (27-30F) (27-30H & 25-26E) (27-30I & 23-26F) (15-18G) Calc. by H based on 21k, 25k, 36k, 37k, 38k, (23-26 ABCDEF & 27-30 ABCDEF) (21-38C & 35-38D) (35-38C) (35-38F) (35-38G, 35H) (35-38G & 35I) Calc. by k based on 7h, 11h, 12h 14m, 44m

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95. ARTERIAL BLOOD GASES, O₂ AND CO₂, AT ALTITUDE: MAN

Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References
1 B E-G	See Table 94	24 C	2	37 B	1b
1 C	2	25 E	4b	37 C-G	6ab
2, 4, 6, 8, 10, 12, 14, 16 B	1b	26 B E-G	4b	38 C-G	6b
2-17 C	2	26 C	2	39 B	1b
2-17 E	3b	27 E	Av. of 1, 3, 4	39 C-E G	6ab
2-17 F	1b	27 FG	4b	40 C-E G	6b
18 C	2	28 B E G	4b	41 B	1b
18, 19 E	3b	29 E	Av. of 1, 3, 4	41 C-G	6ab
20 B E-G	4b	29 G	4b	42 C-G	6b
20 C	2	30 B E-G	4b	43 B	1b
21 B E-G	5b	30 C	2	43 C-G	6ab
21 C	2	31 E	Av. of 1, 3, 4	44 C-G	6b
22 B E-G	4b	32 C	2	45 B-G	7b
22 C	2	32 E	1	46 B-G	9ab
23 E	Av. of 1, 3, 4	33 E	Av. of 1, 3	47 B E-G	7ab
23 FG	4b	34 B-G	1b	47-49 CD	8
24 B E-G	4b	35 B	6a	48 B E-G	7ab
		35 C	6ab	49 B E-G	7ab
		36 C-G	6b	Fn 6	6ab

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References: (1) National Research Council CAM Report "Handbook of Respiratory Data in Aviation," Charts A-1, B-1,

96. IONIC BALANCE AND BUFFER BASE, ARTERIAL BLOOD, CELLS AND PLASMA: MAN

Diagram contributed by Singer, Richard B.

97. ACID-BASE VALUES, BLOOD AND PLASMA MAN

Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References
Fa 1	a, 1a	3 P	23a, 24a	12 FG	1a, 16a, 18a, 19a, 20a
Fa 2	a, 47a, 48a, 49a	6 B-1	40a	12 HK	1a, 15a, 16a, 17a, 18a, 45a
Fa 3	a, 30a, 32a	6 PQ	23a, 24a, 25a	13 L-O	1a
Fa 4	a, 50a, 51a, 32a, 48a	7 B-E	3a	12 FQ	26a, 27a, 28a
Fa 5	a, 32a, 34a, 35a	7 F-O	1a, 3a, 41a	14 BC	1a, 21a
Fa 6	a, 56a, 57a, 1a	9 FG	1a, 41a	14 HZ	1a
Fa 7	a, 58a, 59a, 60a, 61a, 62a, 1a, 63a, 64a	9 HI	61a	14 JK	1a, 11a
Fa 8	a, 65a	9 J-O	1a, 41a	14 LM	1a
Fa 9	a, 1a	9 PQ	23a, 24a, 25a, 26a	14 NO	1a, 11a
Fa 10	a, 36a, 57a, 64a, 1a, 67a	10 BC	1a, 3a, 4a, 5a, 6a, 7a	15 DE	37a
Fa 11	a, 69a, 1a, 29a, 36a	10 DE	38a, 42a, 43a, 44a, 45a	15 FG	1a
Fa 12	a, 69a, 39a, 69a, 70a	10 FG	1a, 3a, 4a, 3a, 6a, 7a, 8a	15 HI	18a, 21a, 22a, 46a
Fa 13	a, 41a	10 HI	1a, 7a, 9a	15 JK	1a, 18a, 22a, 46a
Fa 14	a, 30a	10 JK	1a, 4a, 6a, 8a	15 LM	2a, 21a
Fa 15	a, 1a, 38a	10 LM	1a	15 NO	1a
Fa 16	a	10 NO	1a, 3a, 7a, 8a, 9a	15 PQ	28a
Fa 17	a, 3a, 2a	11 BC	1a, 11a, 12a, 13a	16 B-M	10a
Fa 18	a	11 FG	1a, 11a, 12a, 13a	16 NO	1a, 10a
Fa 19	a	11 HI	1a	17 B-G	1a, 18a
Fa 20	a, 3a, 2a	11 JK	5a, 11a, 12a, 13a	17 HI	1a
3 B-O	28a	11 LM	1a	17 JK	2a, 12a
3 BC	40a	11 NO	1a, 11a, 12a, 13a	17 LM	1a
3 DE	20a	12 BC	1a, 5a, 16a, 19a, 20a	17 NO	2a, 13a
3 H-O	14a, 1a	12 DE	1a, 15a, 16a, 19a, 20a, 37a	18 B-G	10a
				19 HI	1a
				19 JM	10a
				19 NO	1a, 10a

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98. EFFECTS OF RADIATION ON PERIPHERAL BLOOD

Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References
1,2,3 A-E	11a	29 A-E	13a	48-51 ABCDE	8a
4 A-E	20a	30 A-E	2a	52-58 ABCDE	10a
5 A-E	9a	31-34 ABCDE	4a	59-63 ABCDE	6a
6,7,8 A-E	17a	35-39 ABCDE	10a	64,65 A-E	5a
8-13 ABCDE	5a	40 A-E	7a, 17a	66,67 A-E	3a
14 A-E	17a	41 A-E	7a, 14a, 15a	68 A-E	18a
15,16 A-E	3a	42 A-E	7a	69 A-E	12a
17 A-E	19a	43,44 A-E	5a	70 A-E	1a
18-28 ABCDE	10a	45-47 ABCDE	3a		

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1946.

*For information regarding the availability of starred references, the Reference Services Branch, Technical Information Service, U. S. Atomic Energy Commission, Oak Ridge, Tennessee should be contacted.

99. EFFECTS OF RADIATION ON HEMATOPOIETIC TISSUES

Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References
1-10 ABCDEF	8a	35-37 ABCDEF	9a	102-107 ABCDEF	1a
11-14 ABCDEF	10a	38-42 ABCDEF	3a	108-111 ABCDEF	7a
15-17 ABCDEF	1a	43 A-F	1a	112-114 ABCDEF	1a
18, 19 A-F	9a	44-49 ABCDEF	3a	115 A-F	5a
20, 21, 22 A-F	1a	50-60 ABCDEF	1a, 3a	116-135 ABCDEF	1a, 6a
23-27 ABCDEF	3a	61-97 ABCDEF	1a	136 A-F	2a
28-34 ABCDEF	1a	98-101 ABCDEF	7a		

Contributors. Ingram, M.

References: (1) Bloom, W., "The Histopathology of Irradiation," McGraw-Hill, NY, 1948. (2) Bonham, Donaldson, Foster, et al., *Growth* **12**: 107, 1948. (3) Brecher, G., Endicott, K. H., Gump, H., and Brawner, H. P., *Blood* **2**: 1259, 1948. (4) Densted, T., *Acta Radiol. (Suppl.)* **52**, 1943. (5) Hagen, C. W., Jacobson, L. O., Murray R., and Lear, F., *MDDC* **899**, 1944*. (6) McDonald, et al. "Neutron Effects on Animals." Williams & Wilkins, 1947. (7) Metcalf, Inda, et al., *UR* **123**, 1930. (8) Murray, R., Pierce, M., Jacobson, L. O., *CH* **3873**, 1948*. (9) Nettleship, A., *Radiol.* **42**: 64, 1949. (10) Rekers, P. E., *UR* **11**, 1948*.

*For information regarding the availability of starred references, the Reference Services Branch, Technical Information Service, U. S. Atomic Energy Commission, Oak Ridge, Tennessee should be contacted.

100. CHANGES IN STORED PRESERVED BLOOD

Data Coordinates and Footnotes	Contributors and References
1-45 & Fn 1-14	Read from smoothed curves in 1
46	Read from smoothed curve in 2

References (1) Rapoport, S., *J. Clin. Invest.* **26**: 591, 1947. (2) Strumts, M. M., and McGraw, J. J., "Blood and Plasma Transfusions," F. A. Davis Co., Phila., 1949.

101. EFFECTIVE BLOOD LEVELS OF THERAPEUTIC AGENTS. MAN

Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References	Data Coordinates and Footnotes	Contributors and References
1 A-F	1a	16 A-E G	14a	31-33 ABCDE G	a
2 A-F & Fn 1	2a	17 A-F	15a	34 A-F	18a
3 A-F	3a	18 A-F	16a	35 A-F	19a
4 A-F	4a	19 A-F	17a	36 A-F	20a
5-7 ABCDEF	5a	20 A-E G & Fn 4	18a	37-41 ABCDE H & Fn 7	21a
8 A-F	6a	21 A-F	19a	42, 43 A-F & Fn 8	31a
9 A-F	7a	22 A-E G	20a	44 A-F	a
10 A-F	8a	23 A-E H	21a	45 A-E G	32a, 33a
11 A-F	9a, 10a	24, 24 A-E H & Fn 5	22a	46 A-F	34a
12 A-F	11a	25 A-E H	23a	47-49 ABCDEF	35a, 36a
13 A-F	12a	26 A-F	24a	50 A-F	37a
14 A-E H & Fn 2	13a	27 A-E G & Fn 6	25a	51-53 ABCD G	38a
15 A-F & Fn 3	1a	28 A-E G	26a		
		29 A-E G	27a		
		30 A-E G	27a		

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